TRANSFORMING SUBURBIA ONE UBIQUITOUS LOT AT A TIME:

UNDERSTANDING AND MITIGATING THE ECOLOGICAL IMPACTS OF SUBURBAN DEVELOPMENT

A DESIGN PROJECT FOR "SUBURBIA TRANSFORMED 2.0: EXPLORING THE AESTHETICS OF LANDSCAPE EXPERIENCE IN THE AGE OF SUSTAINABILITY" AN INTERNATIONAL COMPETITION FOR BUILT AND UNBUILT (VISIONARY) RESIDENTIAL LANDSCAPES SPONSORED BY THE JAMES ROSE CENTER FOR LANDSCAPE ARCHITECTURAL RESEARCH AND DESIGN

A CREATIVE PRJOECT SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

MASTER OF URBAN AND REGIONAL PLANNING
BY
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ABSTRACT

THESIS: TRANSFORMING SUBURBIA ONE UBIQUITOUS LOT AT A TIME: UNDERSTANDING AND MITIGATING THE ECOLOGICAL IMPACTS OF SUBURBIA
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This creative project seeks to highlight the relationship between the history and values of mid-1900s residential communities in the United States and the ecological impacts that have resulted. This history is instrumental in order to understand the sprawling pattern of suburban neighborhoods that exist on the fringe of nearly every urbanized area. An analysis of the negative environmental impacts associated with the construction and occupation of these suburban homes demonstrates a need for a transformation of sprawling places in order to be more ecologically sound. Case studies highlight suburban developments that have attempted to mitigate particular ecological concerns through design and resident behavior. Research and analysis of case studies contributed to the creative element of this study—an entry for the James Rose Center for Landscape Architectural Research and Design competition entitled, "Retrofitting Suburbia 2.0: Exploring the Aesthetics of Landscape Experience in the Age of Sustainability." Design renderings created for the competition illustrate how a single-family suburban lot in Northwest Muncie, Indiana can be retrofitted for ecological sustainability.

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CHAPTER ONE **INTRODUCTION**

"[The] pre-industrial city was far more compact than today's settlements

due largely to the limited availability of resources and technology

with which to exploit and transport them…

Scale was determined by distances that people

and goods could cover on hoof and foot."-Rudlin & Falk[1]

1.1 SIGNIFICANCE

The oldest of human settlements formed in order to allow individuals to participate in a system in which resources and goods that were necessary for survival could be accessed. Until the early twentieth century, close proximity to these crucial resources was an important factor in the form and function of cities in which people lived. Locating resources, harvesting a quantity that would afford comfortable sustenance, and the ability to efficiently dispose of waste were the processes that drove successful early settlements. This process can be referred to as the 'take-make-waste' system—in which individuals 'take' the raw materials needed to 'make' goods and products and then dispose of the 'waste' created[2]. This process used to occur in a somewhat sustainable fashion; 'taking' was not exceeding the Earth's ability to 'remake.' However, the pace at which this linear 'take-make-waste' process takes place has recently increased exponentially. Many phenomena in the modern built environment can be credited with individuals' ability to consume goods and resources at a pace that is endangering the Earth's natural capital.

The twentieth century marked a significant shift in the way that cities in the United States were formed and the functions that they served. Industrialization, the rise of technology and the development of the American system of railroads led to innovations in transportation, housing, the consumption and transport of natural resources, and many other basic systems. With each of these innovations, American cities experienced a significant transformation in their size, form and function. The summation of these shifts

transformed cities from places in which size and consumption had natural methods of control. Land and natural resources had previously been inherently limited by their ability to be accessed and harvested. Instead, modern innovations have created cities in which vast amounts of energy and resources are expelled in order to accommodate the incredibly consumptive lifestyle of U.S. citizens. Many natural resources can be transported from much greater distances and waste can similarly be disposed of far from its point of origin. Due to this, individuals have become much more spread out across the urban landscape, with little to no impact on their ability to access the resources needed for everyday life. Chapter Two will highlight the growth and change of American residential development in greater detail.

"Attitudes about resource consumption are closely related to growing cities that are removed from nature and natural systems."[3] As technology has transformed our cities, most individuals have adopted an 'if I can't see it, then it doesn't exist' attitude about the impacts of highly consumptive lifestyles. Most individuals are blamelessly ignorant about the impact that careless living can have on the natural systems in a particular eco-region and far beyond. The modern built environment successfully masks the true costs—which include economic, natural and social costs—that result from an entire society living above its means.

One concern driving the environmental sustainability movement is the idea that the residents in industrialized countries, particularly in the United States, are living in overshoot—living above the productive means of the Earth's natural capital. As a tool for measuring the environmental impact of lifestyles, the ecological footprint is the sum

of the resources needed to support one's economic, social and ecological activities. This sum is translated into a defined area of productive land necessary to support individual needs. In the United States, individuals and communities have an ecological footprint that cannot be supported by the Earth's available resources. The Global Footprint Network (GFN) monitors the delicate balance between the Earth's 'budget' of natural resources and the 'spending' of its citizens worldwide. According to the GFN's website, each year since the 1970's, global resource use has exceeded the Earth's capacity to produce the resources demanded. In 2010, the Earth was operating in overshoot starting on August 21[4]. Because individuals are so far removed from the impacts of a 'take-make-waste' system, most are wholly unaware that our society is using resources at a rate that significantly outpaces the Earth's ability to replenish them.

There are many crucial criteria that are considered when calculating an individual or community's ecological footprint. Land use, resource consumption and disposal of waste are some of the significant factors in the ecological footprint equation. When considering these factors, suburban residential development, with its abundance of cheap land and housing and plethora of personal transportation options, clearly exhibits itself at the core of the problem. Chapter Three will provide more detail regarding the consumption of natural resources and other ecological impacts associated with sprawling suburban development.

Sprawling development, which can be characterized by large lots with monotonous architectural styles, has cultivated the blameless ignorance that has become the image of the 'American Dream.' This type of residential development has allowed

individuals to be careless with the use of land and the destruction of natural resources, and has removed them from the knowledge of the strain that is being placed on the Earth's carrying capacity. However, Americans have grown especially fond of this ability to live on the edge of cities while maintaining easy access to the economic and cultural benefits of downtowns and city centers. And they've become rather defensive of the right to do so. In order to mitigate the impact on the Earth's natural capital from this type of residential land use, a physical and psychological transformation of U.S. suburbs is needed. Chapters Four and Five demonstrate how such a transformation could make individuals more aware of the natural resource implications of a consumptive lifestyle, and propose a new model of 'living on the edge.' The task of eliminating suburban development, and its environmental implications, is not a viable or realistic option. Therefore, reforming these places to acknowledge and embrace issues of ecology should be the immediate goal of the individuals that are planning, designing and constructing the built environments in which the United States population lives.

1.2 RESEARCH METHODS

This project explores in great detail the impact of suburban residential development, and suggests a prototype for sustainable site design for single-family residential properties in the modern suburb. It will help to increase awareness of the individual household's ecological footprint in an attempt to improve the relationship between the site and the larger environmental systems. The scope of this work will be limited to land use that is dedicated to single-family housing, particularly in a suburban

context and constructed over the past 150 years. A literature review will concentrate on those factors of consumption that are the result of this type of land development—per capita land use, energy and natural resources exploited for this model, and other ecological and lifestyle trends associated with life on the periphery of a city. The research conducted will also include an investigation of literature on the impacts on water and air quality, native species of plants and animals, local resource conservation and preservation, and waste.

The literature review of the aforementioned issues will support an entry for a creative design competition. This research will provide critical background information regarding the history of housing trends in the United States, residential sustainability, and ecology principles. From this background, connections will be made between suburban living and its impacts on ecological systems. Additionally, case studies of successful sustainable residential sites and neighborhoods will be highlighted in order to understand the crucial components for redesigning with respect to natural systems. Conclusions drawn from this research will influence a design entry that will be submitted for the James Rose Center for Landscape Architectural Research and Design competition entitled "Suburbia Transformed 2.0: Exploring the Aesthetics of Landscape Experience in the Age of Sustainability," a design competition held in 2012. A reflection of the design process and competition experience will form the conclusion of this creative project.

Submission for the James Rose Center competition includes the following criteria: Formulation of a design for a two acre or smaller lot that is zoned single-family

residential, and that highlights an individual lot's unique opportunity to integrate sustainable technologies and systems, better use natural resources, and enhance the aesthetic experience of the user. According to the James Rose Center website, a multi-page PDF document including mapping of the site, a final site plan and images, and an accompanying description constitute the required deliverable for submission.[5]

CHAPTER TWO **SUBURBAN CONSPIRACY**

"The street is bad as an environment for humans; houses should be turned

away from it and faced inward, towards sheltered greens.

Frequent streets are wasteful, of advantage only to

real estate speculators who measure value by the front foot.

The basic unit of city design is not the street but the block,

and more particularly the super-block.

Commerce should be segregated from residences and greens.

A neighborhood's demand for goods should be calculated 'scientifically',

and this much and no more commercial space allocated.

The presence of many other people is, at best, a necessary evil

and good city planning must aim for at least an illusion of

isolation and suburban privacy." –Jane Jacobs[1]

This quote from Jane Jacobs's novel, *The Death and Life of the Great American City*, summarizes the shift in the values of community development that have occurred since the mid-1900's.[2] Though written in 1961, Jacobs's observation about the transformation of human settlements is still relevant when discussing the development priorities of communities in the twenty-first century. Early settlements, which valued nature, localization and vibrant social environments, have long since been replaced by a sort of rubber-stamp-development that boasts uniformity, segregation, and the abandonment of civic life. This chapter summarizes the history and issues associated with this transformation to the sprawling dystopia that is regarded as the 'American Dream' today.

2.1 IF PAST IS PRECEDENT

The oldest of human settlements were formed in order for their inhabitants to access the goods and services that were necessary for survival. Locating the resources, harvesting a quantity that could afford comfortable sustenance and the ability to dispose of the waste materials drove these successful early settlements. These settlements permitted the sharing of these resources as well as the labor that was required for hunting, harvesting and using them for consumption, shelter or trade. Until the early twentieth century, it was this close proximity to these crucial resources that drove the form and function of cities in which people lived. According to Constantinos Doxiadis, a visiting lecturer at Trinity College in 1966, the essential characteristic of early cities was that they maintained a balance between technology and its productive capacity, and population and

the settlements that accommodated it.[3] These civilizations adjusted to the limits of the land and cities remained at a consistent, maintainable size. History highlights many anecdotes of cities that grew up in this exact manner. In his book, *Collapse: How Societies Choose to Fail or Succeed*, Jared Diamond points to the foundations of many ancient societies and their dependence on one or more precious natural resources or systems.[4] Access to waterways, fertile soils to grow food and an abundance of plants and trees to use for shelter were among the examples given of the connections that early civilizations had with the natural world.

The shape of early civilizations demonstrates that their inhabitants valued and respected nature and natural systems for their intrinsic value—for nature's ability to supply the provisioning, regulating and supporting services that supported human life. Individuals had a close relationship with the natural world. These resources were recognized as essential to human well being. In some cultures, natural resources were even worshipped. Humans could see the direct impact the environment had on their existence and, in turn, how their behaviors affected its processes. It was because of this observable co-dependence that many societies were careful to nurture their relationship with the natural world. Damaging nature, or growing beyond its means, was to jeopardize human life. As Rudlin and Falk noted in *Building the 21st Century Home,* the "pre-industrial city was far more compact than today's settlements due largely to the limited availability of resources and technology with which to exploit and transport them…Scale was determined by distances that people and goods could cover on hoof and foot."[5]

Disregard for this intricate relationship with the natural world is precisely what Jared Diamond sought to highlight in *Collapse*. He reminds modern civilizations that prominent ancient societies caused their own demise due to the fact that they lost sight of their connection to nature. Some early societies grew beyond the ability of the natural environment to support human demand for goods and services. These obsolete human settlements used their resources in a linear, non-sustainable fashion. This process can be referred to as the "take-make-waste" system;[6] a system in which individuals 'take' the raw materials needed to 'make' goods and products and then flippantly dispose of the 'waste' created. On Easter Island, every last tree was cut down, eliminating the natural system services—oxygen creation and availability of materials for food and shelter—of those trees that were keeping the island's inhabitants alive. Ancient Mayans engineered state-of-the-art settlements in areas that should not have been able to support human habitation. Potable water and fertile soil to grow food did not exist in these areas and, thus, were harvested and transported into the settlements. Ultimately these settlements collapsed due to nature's inability to support such a demand on its services.[7]

There are obviously many successful societies that were able to engage in the 'take-make-waste' process in a somewhat sustainable fashion. 'Taking' was not drastically exceeding the Earth's ability to 'remake' as it was in places like Easter Island. However, for a long period of time humans have been disconnected from the natural world and its inherent benefits that support their existence. Modern societies have again been pushing the limits of the natural environment and the pace at which this linear consumption process has been taking place has been increasing exponentially. All

throughout the life cycle of the products that are used to manufacture the communities in which the United States population resides, natural resources are being used in such a way that ends in waste, with little opportunity for these resources to be reused or replenished. Many scientists and scholars would argue that the lessons of Easter Island and the ancient Mayans should be taken as a warning. Individuals like James Howard Kunstler strongly caution modern civilizations against growing even further beyond their means of existence, and encourage the adoption of more conservative methods of resource consumption.[8] One such phenomenon allowing modern society's consumptive behavior is the growth of the cities—cities that have grown upward and outward. These cities are replacing the natural environments that once functioned as the very resource supporting the early human settlements that they evolved from. As modern communities are increasingly bland and uniform, individuals have adopted the attitude that these places are one in the same. Nothing is permanent, unique or highly valuable. Author Timothy Beatley, in *Native to Nowhere*, argues that until residents are able to identify real connections to unique environs, unsustainable consumption and resource use will be difficult to mitigate or reverse.[9]

2.2: DRIVERS OF CHANGE AND OUTWARD MIRGRATION

As previously mentioned, the twentieth century marked a significant shift in the way cities in the United States were formed and the functions they served. An analysis of urban form in the United States over the last century indicates that sprawl is a trend that is closely related to a multitude of social, physical and technological advances that have

occurred over time. Industrialization, the rise of technology and the growing network of railroads led to innovations in transportation, housing, natural resource consumption and shipment, and many other basic systems. With each of these innovations, American cities experienced a significant transformation and the summation of these shifts transformed cities into places that abandoned natural methods of growth management. As the quote at the beginning of this chapter illustrates, sprawling suburban communities are ones in which values have moved away from social connections, civic life and environmental considerations. Like ancient Mayan civilizations, these technological innovations have created cities in which vast amounts of energy and resources are expelled in order to defy the limits of nature and accommodate the incredibly consumptive lifestyles that are widespread among U.S. citizens. Because of this, individuals have sprawled themselves across the urban landscape, with little limit on the availability of the resources needed for everyday life.

Sprawl is not only redefining the physical appearance of our communities, but is changing the decision-making processes of those involved in designing and engineering them. Demand for the suburban lifestyle has driven the architects of suburban prototypes to make decisions regarding resource consumption, which place more value on the assembly of this model, rather than the health and viability of the natural resources and human settlements that are a result. James Howard Kunstler frequently discusses these issues, pointing out that the way in which our settlements are becoming so large and consuming resources so rapidly is undoubtedly leading to the collapse of these residential communities.[10]

Trends in city growth started shortly after the industrial revolution. These trends, especially in residential growth on the periphery of cities, have boomed in the last sixty or so years and have grown at an exponential rate in more recent decades. In the early 1900's, some of the most prestigious places to live were in or very near the city's center. In these early cities, citizens wanted to be near social activities, places to obtain food, and facilities for learning and working. As advances brought new challenges and opportunities to early American cities, attitudes regarding an ideal living environment began to shift. As the authors of *Building the 21st Century Home* have identified, there were four significant attitudes that led to the mass exodus from these traditional human settlements, which include: enjoying the benefits of nature, escaping the ills of the city, the separation of home and work, and the acquisition of affluence and status.[11]

The intense scale and rapid pace at which industrialized cities started to grow soon revealed many problems. In a haste to establish a built environment to accommodate a rapidly growing population, product line, and consumer demand, a haphazard method of development was engaged. "During the industrializing decades before and after the turn of the twentieth century, private developers expanded towns into cities at an amazing clip. Land was cleared, swamps were drained, streams and rivers were put into pipes and the profit motive discouraged the use of land for parks. Coal heat and smoke stack industries polluted city air. Runoff and untreated sewage contaminated surface water bodies."[12] City development during this time can be compared to a bulldozer simply eliminating every tree, bird and blade of grass in order to pave the way for the assembly-line-production of a consumer culture.

Because of the quick and narrow-minded development of these early industrialized cities, settlements rarely included natural areas or vegetation. Nature was an afterthought, a product that could easily be removed in order to construct the urban paradise. Many early U.S. cities did not even have parks and open spaces for people to enjoy the benefits of nature. In place of the scenic natural beauty that existed prior, some cities were fortunate to enjoy a solitary tree in a sterile, uninviting urban park. At the same time, early twentieth-century cities were becoming overcrowded which led to public health risks including the quick spread of communicable disease, poor air quality, and other pollution issues. The absence of the services traditionally provided by natural systems and the overcrowding of early cities allowed for disease to run rampant. Thus the belief developed that being disconnected from nature was detrimental to the health of individuals and that moving to the countryside would remedy the ills of the city. (Figures 2.10 & 2.11)

In response to these public health concerns, laws were developed—in the form of land use regulations and zoning—that dictated what land uses could be located in a particular area of a city. The purpose of these land use regulations, often referred to as Euclidean Zoning, was to protect public health by separating potentially noxious uses, like factories and other sources of pollution, from residential areas and public open spaces.[13] Notable works such as the 1909 Plan for Chicago and the planning of Central Park in New York mention these public health concerns and advocate the need for these laws which created very distinct districts in which residences, business, factories, and public uses could be located. However, this form of restrictive zoning was incredibly

specific; so much so that many people were no longer able to work near where they lived, nor have access within walking distance to many of the basic amenities of early cities.

Combined with public health concerns from overcrowding and the lack of nature, citizens of mid-twentieth century cities adopted the idea that density was a bad thing and moved away from city centers to return to the country. Families relocated not only to escape the ills of the city, but also to escape from other people. The idea of once again living in tune with nature seemed to be the solution to being free from the disease and pollution of the city. However, people weren't really rejoining nature—they were moving to residential subdivisions with single-family, detached housing with large yards and personal vehicles. Despite destroying the very nature they were pursuing by building these highly secluded neighborhoods, this became an attractive way to live.

A third attitude was developing as individuals began working extended hours. Non-city dwellers believed that home and work environments were separate places. This contributed to the commuter's lifestyle that is all too common today. The new residential developments were a retreat from the everyday hustle and bustle of the city and employment centers. Cities and neighborhoods transformed from places where people were encouraged to walk, with a diversity of amenities nearby, into places where solitude and transportation innovations were the primary drivers of development. Transportation innovations such as street car and interurban rail service allowed for the growth of cities outward and for people to conveniently move back and forth from city center to edge. Combined with Euclidean zoning regulations, places for working, shopping and living became largely separated. Traveling between them became a routine that was costly—

both in time and money—and energy intensive. But those that could afford it were considered to have achieved a comfortable and successful quality of life.

The final attitude that influenced the shape of American industrial cities was the impact of affluence on the pattern of the built environment. In a society that was growing around its ability to produce new products, and the boom of housing associated with the return of war veterans, the quest for a quality of life that included homeownership outside of the city center was driving individuals into the suburbs. The demand for new housing was so great, and came with a specific set of criteria that rebelled from the traditional building pattern of existing cities. In order to meet this demand, many green-field areas, areas that were previously forested or agricultural land, on the fringes of cities were cleared and large homogenous subdivisions were platted. Living in brand new, residential suburbs far from the city center became a measure of one's affluence and success. In fact, Lewis Mumford, in his essay *The Highway and the* City, noted that for many Americans discarding what was old and accepting what was new, simply because it was new, was a sign of progress and achievement.[14]

Although outside the scope of this work, it should be noted that there were many social and economic criteria that influenced this migration toward the suburbs. Despite the suburbs having supposedly corrected the ills of the cities, homeownership was enticing and made incredibly affordable by the Federal Housing Administration's (FHA) loan stipulations and other governmental benefits for war veterans. Over decades, this suburban model has resulted in cheaper costs of living—property taxes, housing costs—and perceived to have better public amenities—higher performing schools and cleaner

public spaces. (Figure 2.12) It is no wonder that this model for living became incredibly desirable. Some would even argue that it is no longer an issue of Americans aspiring to live in these sprawling communities. Rather, they argue that families are being driven to these places as a result of economic factors. In some instances this is accurate. Certainly, early regulations by the FHA which favored single-family new construction over mutli-family and undervalued older properties essentially eliminated the choice in where individuals purchased a home.[15] However, decisions made for short-term economic stability in the present are jeopardizing long-term ecological sustainability for the future—a concept which will be discussed thoroughly in Chapter Three.

2.3: GROWTH OF THE SUBURBS

For this section, which explains the specific events leading to the pattern of development that is common in American cities, the terms 'sprawl' and 'suburbs' will be used interchangeably. 'Sprawl' is the pattern of urban growth characterized by low-density development occurring a significant distance from a city's core, expanding its edge conditions and creating a fragmented street network. According to *Urban Sprawl and Public Health*, sprawl is "dispersed, auto-dependent development outside of compact urban and village centers, along highways and in rural areas."[16] Common features of sprawling communities include residential subdivisions built within the last fifty to seventy years, strip commercial centers and big box retail stores surrounded by vast parking lots, and drive-up fast-food services oriented towards convenience for the automobile. In the sprawling expanses of our cities, unique place-making elements are

lost and the scenery is replaced with endless chain stores, grossly oversized office parks and major institutional facilities and ubiquitous suburbs. Typically, this growth happens in a piecemeal fashion with little concern for comprehensive land use strategies. Rather than being carefully planned to promote connectivity and the efficient use of existing infrastructure, sprawling development involves individual land use decisions and short-term solutions for growth management issues. 'Suburbs' are components of sprawl, and refer more specifically to clusters of residential-only development. Chapter Three will discuss the suburbs as an exclusive, residential-only component of sprawl more in depth. However, in this chapter, for the purpose of providing an understanding the history of this type of development, the two terms will be used synonymously.

As a reaction to the public health concerns and other attitudes regarding early American cities that were previously discussed, new models of residential development were explored. Much before the mass production of mid-twentieth century manufactured suburbs, Ebenezer Howard suggested that the garden city was the ideal city in the United Kingdom; an idea that spread to the United States in the 1800's.[17] These cities, such as Garden City, New York sought to address many of the concerns of the city and allowed families to move to communities where these ills would not be existent. Garden cities and suburbs were planned communities that were surrounded by greenbelts and were intended to function as satellite cities to nearby larger cities. These cities were not to grow beyond a particular size or population, and had a distinctive pattern which included a radial road system and segregated land uses separated by much open and park space. These suburbs were accessible by their road network, but also allowed the opportunity for

rail travel between each of the satellite garden cities and the major city nearby. The concepts of these garden cities acted as a spring-board for future suburban development. Though still embracing nature and access to public transit, the garden city movement was the first example of a 'rubber stamp' residential model that could easily be replicated anywhere. It led to the development of mass-produced subdivisions that were to follow during the mid-twentieth century. (Figure 2.13)

Prior to the Second World War, residential housing was beginning to move to the edge of cities, but was still fairly compact with grid-like patterns. However, "somewhere in the history of suburbia, we stopped making towns and began making 'pre-improved' subdivisions in which all of the houses were built before residents arrived."[18] The new pattern of sprawling development can be connected to the post-WWII housing boom. Places like Levittown, Pennsylvania and Levittown, New York, which was a neighboring suburb to aforementioned Garden City, became tangled webs of residential development in which housing models could be selected from a menu of options, promptly constructed and move-in ready in very short periods of time. (Figures 2.6 & 2.7) Following the war, Americans had an attitude of entitlement that allowed them to live as extravagantly as they desired, and to disregard the financial and environmental consequences of such lifestyles.[19] Fields, farms and forests were quickly cleared and replaced with a cookie-cutter image of the 'American life.'

This trend in creating sprawling, monotonous residential developments may have started with the end of WWII, but did not stop in the years following the meeting of veterans' needs. In fact, from 1950 to 1990, U.S. metropolitan areas expanded by nearly

377,000 square miles and 109 million people.[20] While population and land area were growing, so was the amount of land each person occupied—urban areas grew so fast that the rate at which land was consumed was 50 percent higher than the growth of the population.[21] Due to tools such as private home loans, cheap construction costs due to mass production and housing development companies eager to make a profit, the periphery of the city grew at an outrageous pace. In a report published in 2000 by the United States Agricultural Department's Natural Resources Conservation Service, it was noted that developed land in the United States between 1982 and 1992 was growing at a rate of 1.4 million acres per year. In the next five years however, from 1992-1997, this rate increased to an astounding 2.2 million acres per year. Moreover, the report noted that Cook County, Illinois and several of its surrounding counties experienced a four percent increase in population between 1970 and 1990. Land development increased at a much greater rate than did the population, with 33 percent more developed land in the same counties during the same time period.[22] These statistics highlight that cities are not only growing in terms of population, but individuals are consuming more land per person, forcing cities to grow in terms of land area; this rate of growth is quickly leaving less and less undeveloped area.

And the trend did not slow as the twenty-first century neared. According to *Urban Sprawl and Public Health*, twenty-five percent of all of the land that has been developed since the formation of the U.S. was developed between 1990 and 2005 and the share of the U.S. population in suburban parts of metropolitan areas rose to fifty percent by 2000.[24] The rate of sprawl in the United States in the early 2000s was increasing at an

astronomical rate of nearly two million acres a year.[25] This rapid development on the periphery of cities has led to massive disinvestment, poverty and socioeconomic grouping in the once thriving central cities. Many human settlements are now mere rings of sprawling development surrounding impoverished former city centers and surrounded by fragmented rural edge communities. (Figures 2.1 through 2.5)

The cost of building communities in this fashion is high—both in direct and indirect costs to users and developers. Sprawling development requires a more expansive network of infrastructure to support residential and commercial needs, and is almost always required to be new infrastructure. Often times, sprawling areas have organic street networks that lack pedestrian infrastructure. Sidewalks are not always implemented due to the simple fact that there is no nearby destination for pedestrians to walk to. Sprawling areas have been designed to move cars and the humans traveling in cars—they were not planned for safely and efficiently moving people. These features lead to poor connectivity, which means that the automobile is necessary for traveling even the shortest of distances. (Figure 2.14)

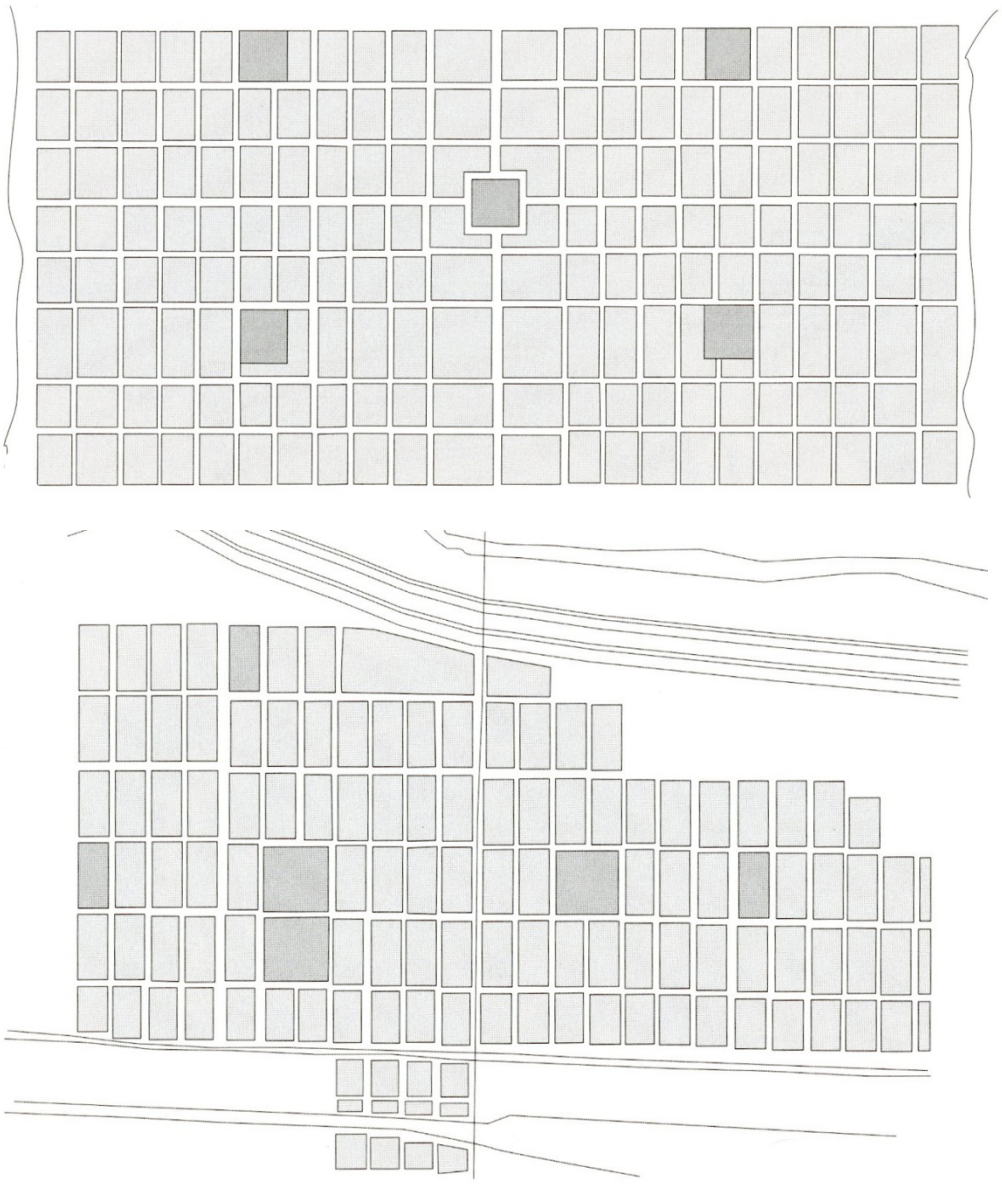
In addition to its impact on the social sphere and lifestyles of individuals in cities, sprawl and suburban development have had a significant impact on the conditions of the natural environment and its resources. "We develop subdivisions, commercial strip malls, and office complexes that ignore the intrinsic defining physical features and qualities of place. We ignore the topography, the existing vegetation patterns, the native flora and fauna, and the natural breezes and microclimatic conditions that are so important in shaping and defining a location."[26] However, most individuals are

blamelessly ignorant about the impact that this type of living can have on the natural systems in a particular region and even across the world. The built environment that has been created successfully masks the true costs—economic, natural and social—that are a result of an entire society living above its means.

The development of these areas of our communities grew in a manner that was largely uninhibited by the idea that many natural resources are a finite commodity. Living on the periphery seemed to become less of a choice for many families from an economic standpoint. Now, as technology has transformed our cities, many individuals have adopted an 'if I can't see it, then it doesn't exist' attitude about the impacts of their consumptive lifestyles. Environmental considerations have been so far removed from the vision of modern American suburbs and individuals simply see these places as areas of convenience and affordability. Inhabitants of these places are not allowed to see the ecological impacts of this development, because natural elements and systems are eliminated before they arrive and replaced with the image of a friendly, comfortable environment that seems to be ideal.

The results of this attitude will be discussed at length in Chapter Three, but it is certain that the sprawl, contamination, pollution, disappearing natural features and other adverse effects are a reflection of this lack of civic and ecological consciousness. Sprawling suburban areas and the ecological impacts associated with this lifestyle can be regarded as one of the most serious threats to the sustainability of natural system resources and humanity. It is typical for modern developments to destroy existing ecological and historic features by replacing them with monotonous subdivisions.

Sprawling, wasteful land use patterns are a large contributor to the American ecological footprint, consume high amounts of energy and generate much greenhouse gas pollution. Additionally, sprawl can be looked to as a major cause of natural habitat and biodiversity loss across the world.[27] Americans have grown especially fond of this ability to live on the edge of cities while maintaining easy access to the economic and cultural benefits of downtowns and city centers, and are rather defensive of the right to do so. In order to mitigate the impact on the Earth's natural capital from this type of residential land use, a physical and psychological transformation of U.S. suburbs is needed. Such a transformation should make individuals more aware of the natural resource implications of a consumptive lifestyle, and propose a new model of 'living on the edge.'

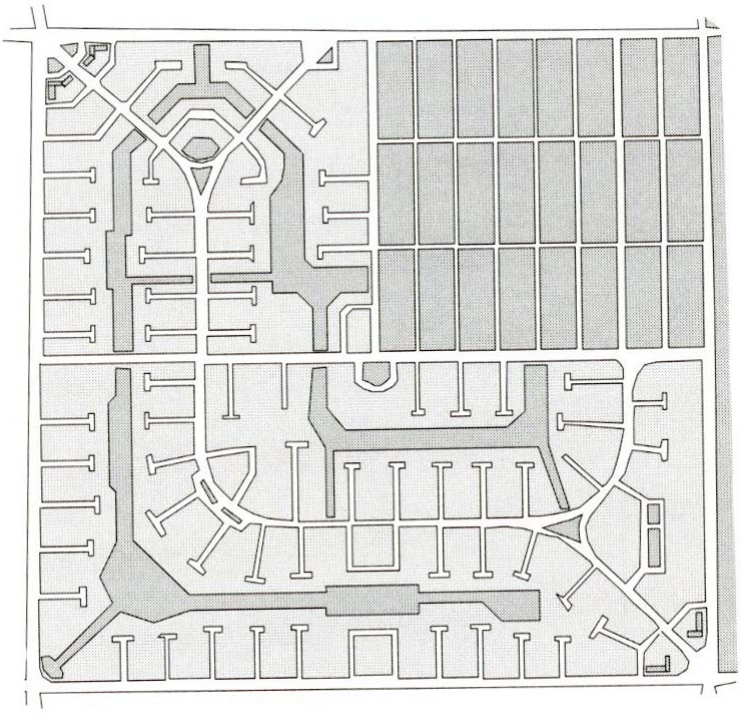


Early city plans demonstrate the compactness and concern for natural resources of pre-Industrial Revolution communities in the United States. (From top to bottom)

Figure 2.1: Philadelphia, PA circa 1683. *Source: Easterling, Keller. American Town Plans: A Comparative Timeline, p 19.*

Figure 2.2: Gary, IN circa 1905. *Source: Easterling, Keller. American Town Plans: A Comparative Timeline p 38.*

*Note: Images are not to scale, are not of a comparable proportion to each other and, unless otherwise noted, are oriented such that north is represented by the top of the page.



City plans demonstrate the impact that suburban sprawl has on land use and development patterns. (From top to bottom)

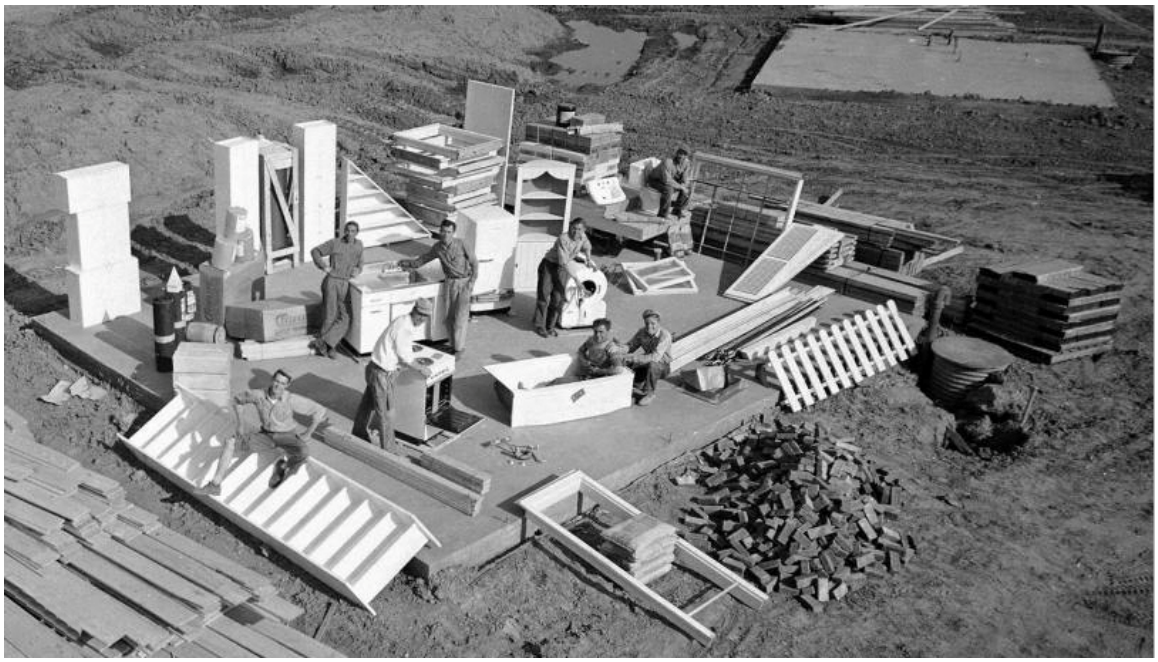
Figure 2.3: Rosedale Gardens, an early suburb of Detroit, MI circa 1930, shows that early suburbs were immediately adjoining urbanized areas. *Source: Easterling, Keller. American Town Plans: A Comparative Timeline, p 56.*

Figure 2.4: Reston, VA circa 1962 illustrates the haphazard and disconnected pattern that developed with other technological innovations of the Industrial Revolution. *Source: Easterling, Keller. American Town Plans: A Comparative Timeline, p 73.*

*Note: Images are not to scale, are not of a comparable proportion to each other and, unless otherwise noted, are oriented such that north is represented by the top of the page.

Figure 2.5: Levittown, NY circa 1947 epitomizes post-WWII neighborhood growth and is generally regarded as the birthplace of modern American sprawling suburban development. *Source: Easterling, Keller. American Town Plans: A Comparative Timeline, p* 67

*Note: Image is not to scale, is not of a comparable proportion to maps on proceeding pages and, unless otherwise noted, is oriented such that north is represented by the top of the page.



Figures 2.6 & 2.7: Levittown, NY circa 1947-1948 illustrate the methodical, monotonous clearing of land and natural resources for the development of the American Dream. *Source: Hales, Peter. Building Levittown: A Rudimentary Primer. <http://tigger.uic.edu/~pbhales/Levittown/building.html>*

Figures 2.8 & 2.9: Aerial images of modern-day Levittown, NY (top) and Levittown, PA (bottom) illustrate the nearly identical pattern of suburban sprawl that characterizes many American neighborhoods today. *Source: Google Earth.*

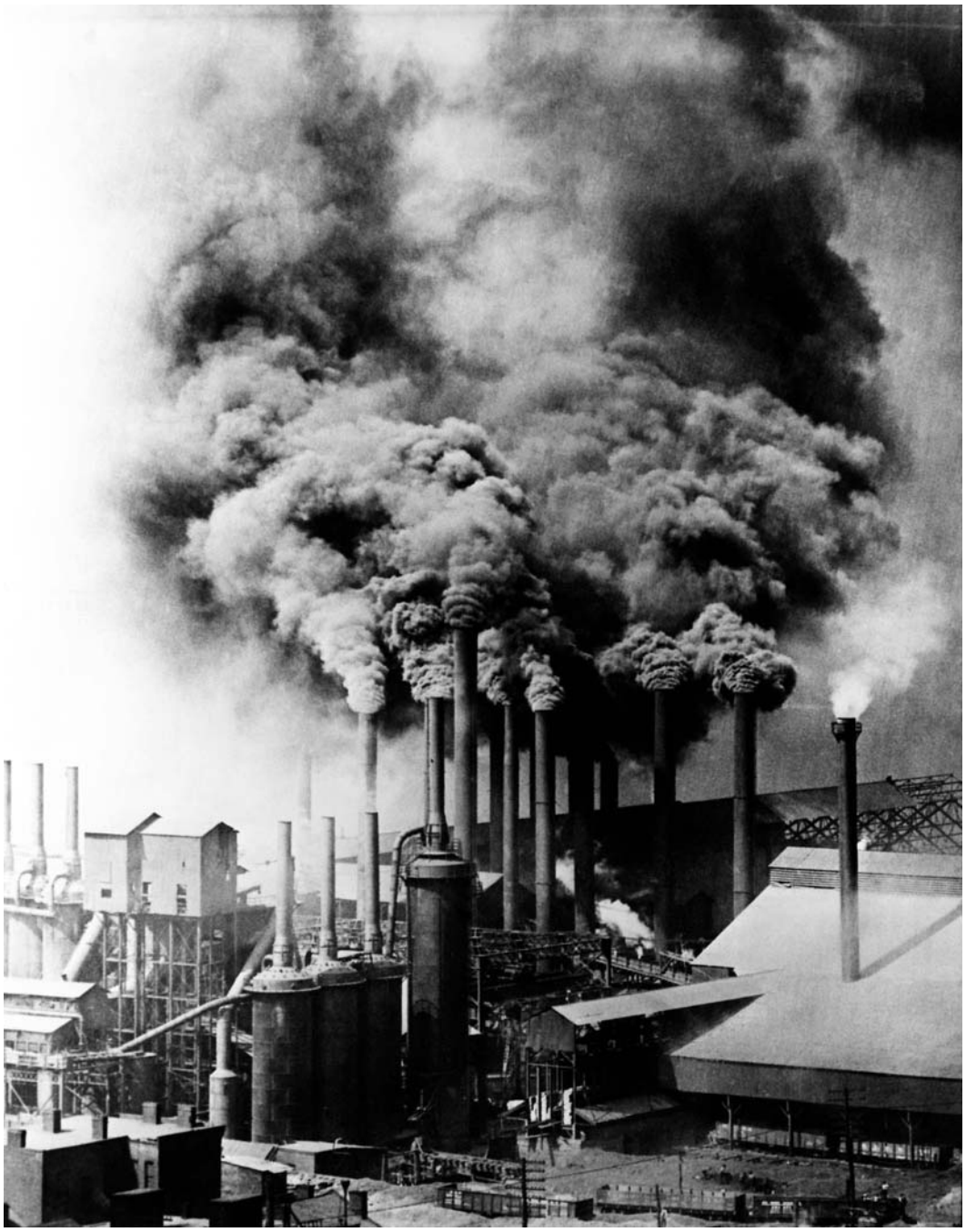
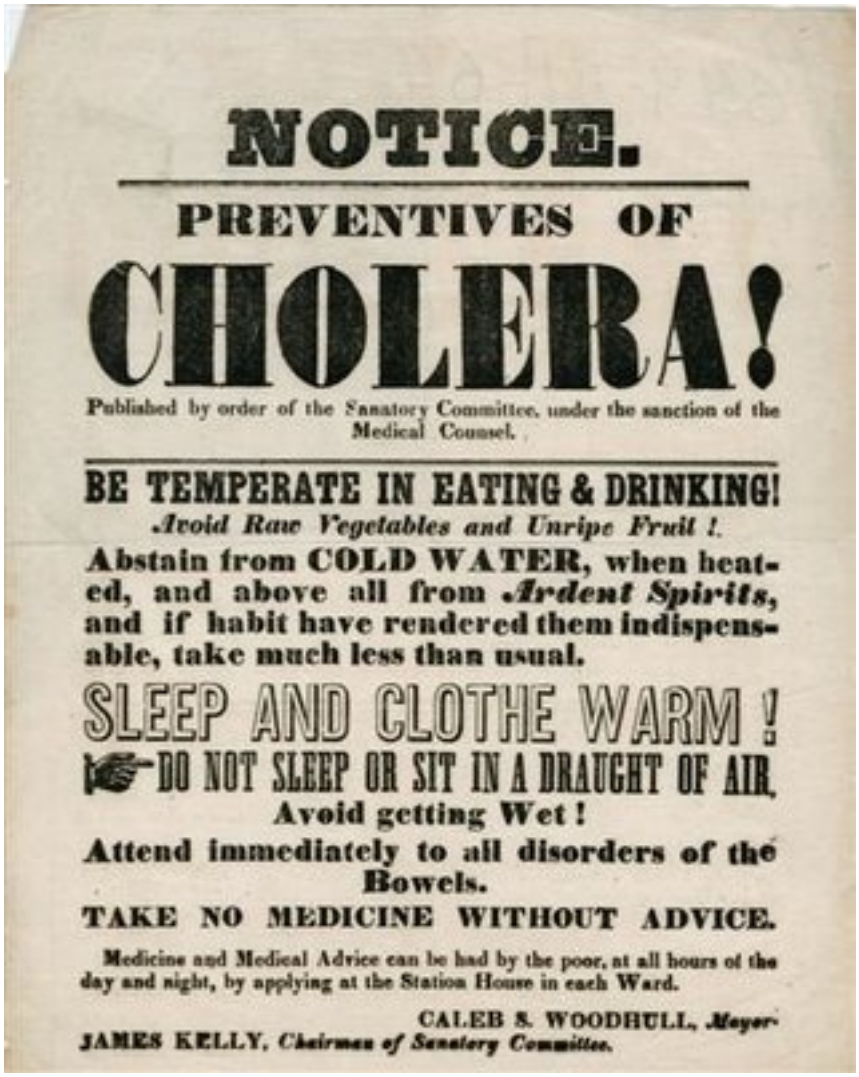


Figure 2.10: Photograph of Pittsburg circa 1906 shows the pollution from early industrial cities that led individuals to flee from dense city centers and the ills associated with urban life. *Source: Explore PA History.* < *http://explorepahistory.com/displayimage.php?imgId=1-2-444*>



NOTICE.

PREVENTIVES OF

CHOLERA!

Published by order of the Sanatory Committee, under the sanction of the Medical Counsel.

BE TEMPERATE IN EATING & DRINKING!

Avoid Raw Vegetables and Unripe Fruit !.

Abstain from COLD WATER, when heated, and above all from *Ardent Spirits*, and if habit have rendered them indispensable, take much less than usual.

SLEEP AND CLOTHE WARM !

DO NOT SLEEP OR SIT IN A DRAUGHT OF AIR.

Avoid getting Wet !

Attend immediately to all disorders of the Bowels.

TAKE NO MEDICINE WITHOUT ADVICE.

Medicine and Medical Advice can be had by the poor, at all hours of the day and night, by applying at the Station House in each Ward.

CALEB S. WOODHULL, *Mayor.*

JAMES KELLY, *Chairman of Sanatory Committee.*

Figure 2.11: Public health notice warning about the spread of Cholera in early industrial cities around the turn of the 20th Century. *Source: Brown, Richard. "Looking at History." <*[*http://richardjohnbr.blogspot.com/2010/11/disease-in-victorian-city-extended.html*](http://richardjohnbr.blogspot.com/2010/11/disease-in-victorian-city-extended.html)*>*

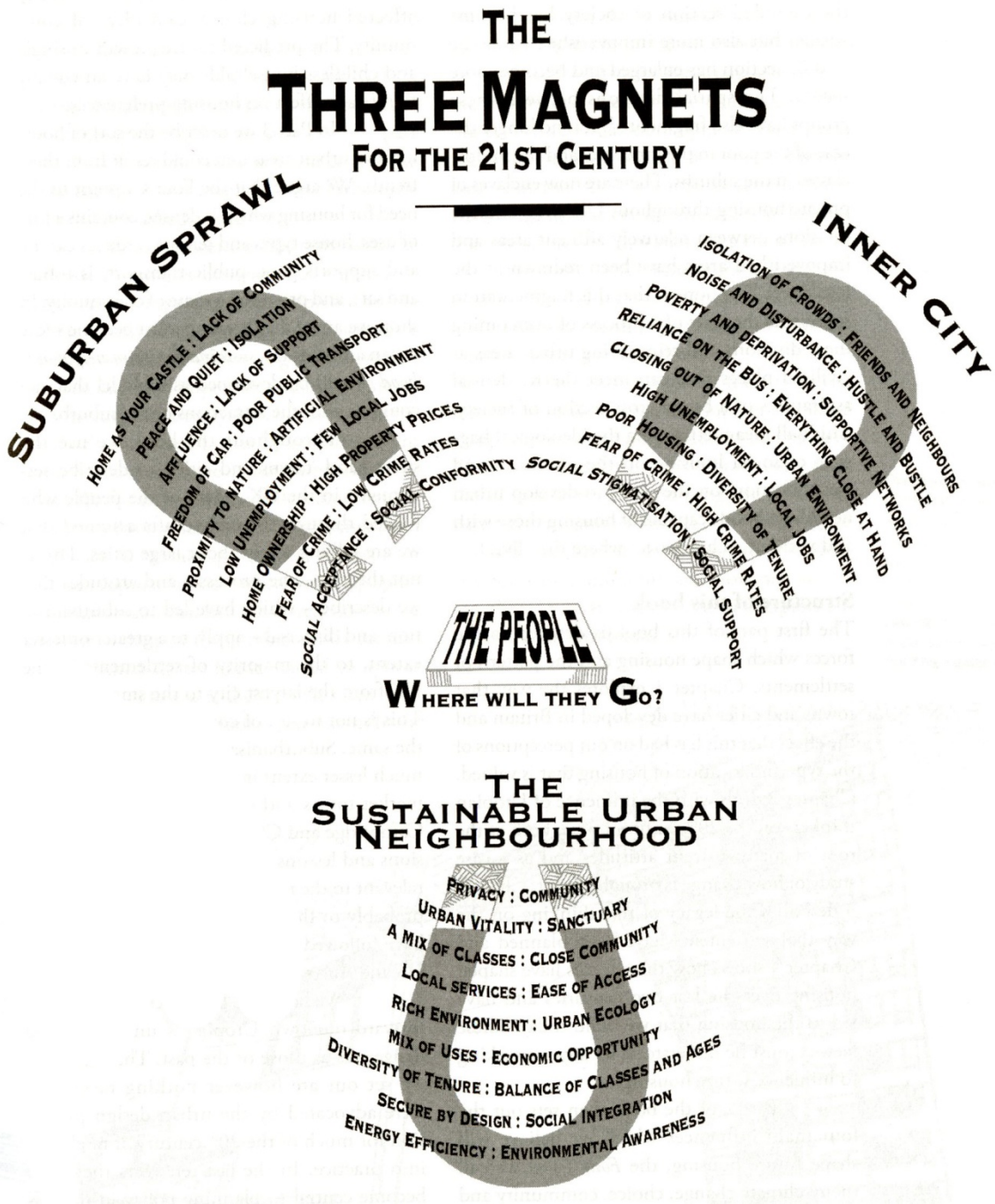


Figure 2.12: Diagram illustrating the issues associated with and values of people living in various types of settlements—both in the past and for the future. Adapted from Ebenezer Howard's three magnets. *Source: Rudlin & Falk. Building the 21st Century Home: The Sustainable Urban Neighbourhood. p 11*

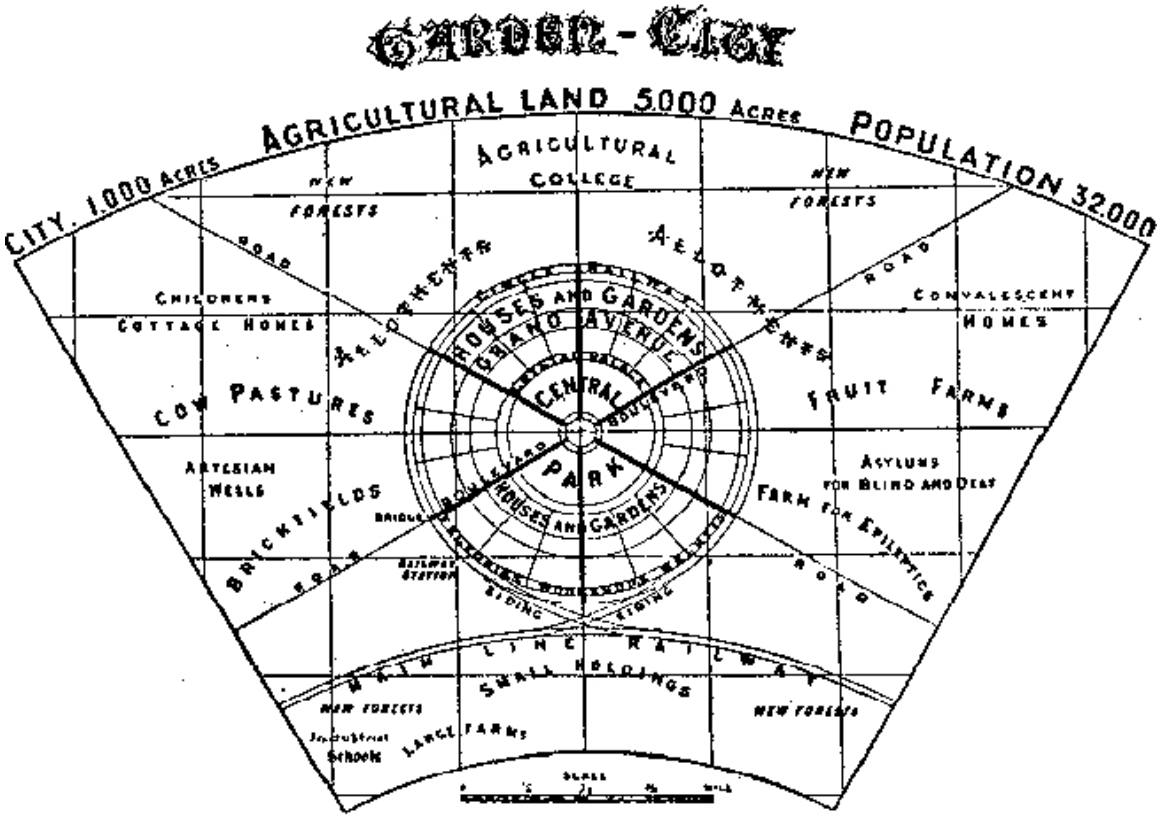


Figure 2.13: Diagram illustrating Ebenezer Howard's model for a garden city. *Source: Reps, John W. "Garden Cities of To-Morrow by Ebenezer Howard." Urban Planning 1794-1819, Cornell University. <http://www.library.cornell.edu/Reps/DOCS/homepage.htm>*

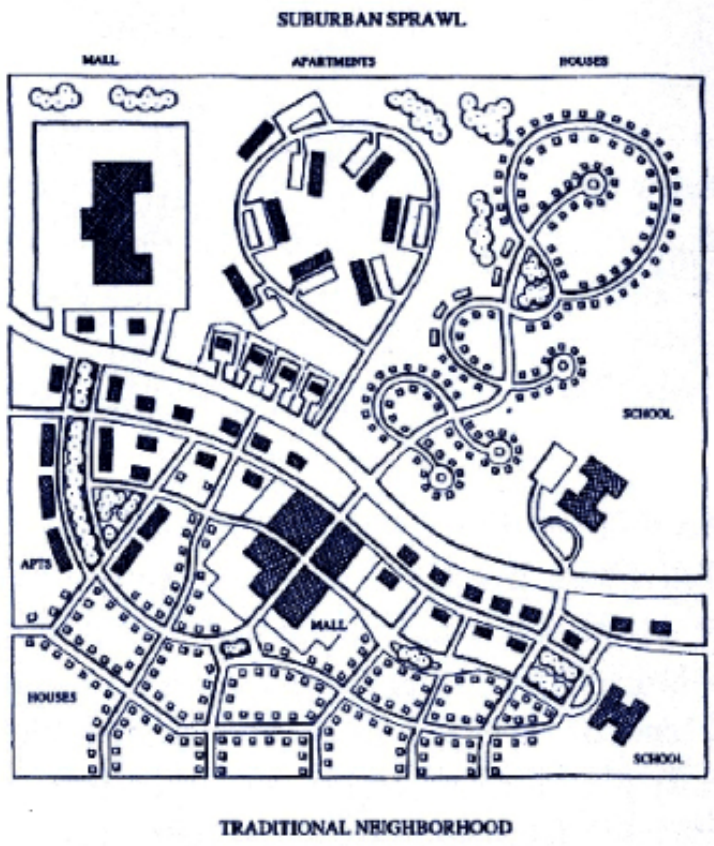


Figure 2.14: The arrangement of similar land uses in urban and suburban settings are much different. Much more land is consumed, and wasted, when accommodating sprawling land development patterns. *Source: Duany, Andres, et.al. Suburban Nation: The Rise of Sprawl and the Decline of the American Dream.*

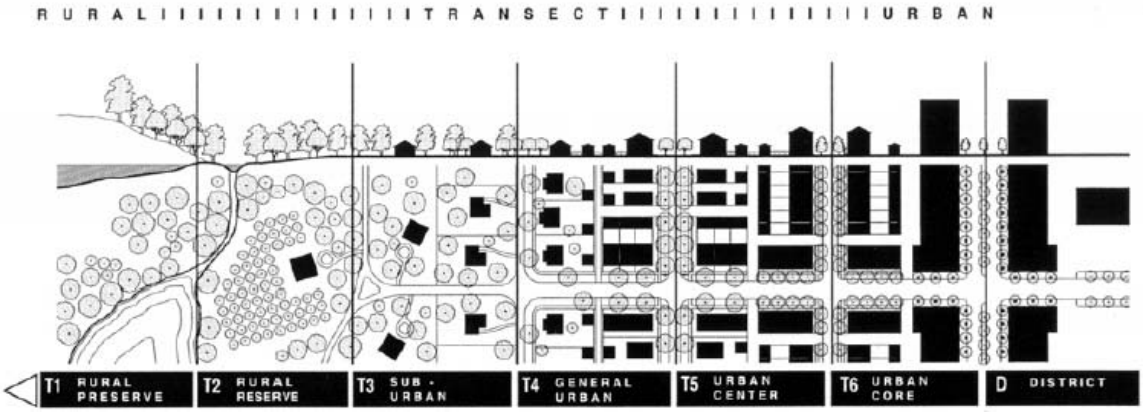


Figure 2.15: The Rural to Urban transect demonstrates how land is divided and developed in various contexts. *Source: Congress for New Urbanism and the Institute of Transportation Engineers. Designing Walkable Urban Thoroughfares: A Context Sensitive Approach.*

CHAPTER THREE **ECOLOGY OF THE SINGLE-FAMILY HOME**

"This imposed and artificial infrastructure has replaced the

local and natural function of the landscape in providing for our basic needs,

leaving the landscape with no essential functions in our lives.

We need to reestablish the landscape in our consciousness as the source of life,

not an adjunct to roads and buildings

but the essential living matrix within which roads, buildings

and the whole complex composition of urban life can achieve a sustainable state."

-Charles Kilbert[1]

3.1 ASSESSING THE VALUE OF NATURE

There are many services provided by nature, called ecosystem services, that are valued by human beings and many connections and interdependencies within the natural environment that support happy and healthy lives. (Figures 3.1 through 3.3) As Timothy Beatley stated, "we are social creatures, to be sure, but we are also creatures that need contact with nature and other forms of life."[2] Beatley pointed out that the natural environments in which our subdivisions have been built contain important elements that are essential for healthy human places, and that creating connections to these natural elements is not something that should be considered with afterthought. Instead, he argues that contact with nature and its life-supporting processes is absolutely necessary to maintaining well being and emotional health.

However, many of the significant benefits of nature go unnoticed on a daily basis as individuals have come to take for granted the valuable services, products and intangible benefits that are a result of a physical and psychological connection with the natural world. Those that understand and appreciate humans' dependency on the natural environment have come to regard these services as the inherent values of nature. These values include the intrinsic, aesthetic and sociocultural ideals that are placed on nature by humans. Each of the inherent values represents a category of ecosystem services that are provided by nature's processes and interactions. In order to understand and appreciate the essential functions of the natural environment, it is important to define these values of nature and determine what ecosystem services they represent. (Figure 3.4)

The first set of environmental values, nature's intrinsic values, can best be defined as the processes and interdependencies that are essential to life and that make up nature in its most basic characteristics. Appreciating the intrinsic values of the environment is the recognition that some natural processes just happen and, as long as these processes are not significantly disturbed, will continue to happen. This idea is sometimes described as recognizing nature simply for nature's own sake. Nature's intrinsic values include the provisioning, regulating and supporting services that take place in natural environments and that are essential for sustaining human life.[3]

Simply put, the provisioning services of nature seek to accommodate the demand placed on it for providing goods and services. These provisioning services include the goods and resources that are naturally occurring and can be used for sustenance and sustainability such as food, water, and forest products.[4] Provisioning services accommodate the life cycles of innumerable species including humans, wildlife, vegetation and organic matter. Nature's regulating services are those that help maintain balance and stability within ecosystems and other natural environments. These regulating services help control processes that occur at a global scale as well as within individual microclimates and ecosystems.[5] These services include things like the regulation of global temperature and weather patterns, the mitigation of imbalances that cause flooding and other natural disasters, and the cleansing and preservation of air and water quality. Finally, nature's supporting services are those that link various natural processes together and accommodate the proper function of the provisioning and regulating services.

Supporting services include cycles such as soil formation, forest succession, photosynthesis and water and nutrient cycles.[6] (Figure 3.9)

All of the provisioning, regulating and supporting services are essential functions of the natural environment in order to support human life. The uninterrupted function of these supporting cycles is critical because without them, many of the provisioning and regulating services would not have the basic biological or geological components needed to operate effectively. For example, trees and urban vegetation can regulate temperature, mitigate air pollution and control storm water, as well as enhance a place's aesthetic value and quality of life. By understanding what functions are provided by the intrinsic values of nature, it becomes easier to understand how humans are dependent the undisrupted operation of these services. These basic services often drive preservation ethics and legal regulations that strive to protect natural areas in their most pristine state.

These naturally occurring processes also contribute to the appreciation of nature for its aesthetic and sociocultural values. Aesthetic and sociocultural values focus less on nature for nature's sake and focus more on nature for humans' sake. Aesthetic values represent the importance that has been placed on preserving and enjoying natural environments simply because they are beautiful. Valuing the aesthetics of the natural environment is closely related to the reasons why some individuals want to live in scenic environments and vacation in places with stunning natural landscapes and geological formations. Trends in land development and tourism are a testament to the fact that humans like to be near nature due to the fact that its magnificence can provide positive psychological and social benefits. Individuals that have placed a high aesthetic value on

nature are generally passionate about its preservation in order to ensure that its grandeur is not jeopardized, and can be maintained in a usable form to be enjoyed by future generations.

Sociocultural values represent the worth that is placed on the products and services of the natural environment for consumption and harvesting. Individuals that place a high sociocultural value on nature see it for its economic potential, its use for recreation or for education and spiritual fulfillment. Valuing nature for its economic potential is evident in the selling of farmland for development, harvesting of trees for the lumber industry and the use of naturally occurring materials for the creation of an entire assortment of products for human use. When considering sociocultural values, consuming nature is about more than the use of the provisioning services of nature for sustenance, and includes using nature for activities such as recreation and transportation. Consuming nature, in this sense, may not literally mean that nature's resources are used in a way that will permanently alter them or leave them unavailable for others. Rather, consumption includes the use of natural products and services in the natural environment as a means to an end—regardless of whether those gains are economic, social or psychological satisfaction. For example, water resources could be used for swimming or boating. These water sources do not disappear after being used, but rather, may be changed such a way that they cannot be used for drinking water in the future, thus, the water is 'consumed' by humans. Finally, some individuals place a high value on nature for its ability to provide an environment for education and worship. Using nature for its educational and spiritual benefits include observing the operation of ecosystem services,

recognizing the myriad of plant and wildlife species, and utilizing nature for meditation or engaging in spiritual experiences.

Despite the ways in which essential and non-essential functions of human life are supported in nature, many individuals overlook these processes and services. Disregard for this intricate relationship with the natural world has led to inventions for and activities within human civilizations that jeopardize the natural environments and ecosystem services that are known to be highly valuable for any number of reasons. Much evidence leaves little room to doubt that humans need natural systems in order to survive, for psychological, spiritual and emotional health and to provide the processes and benefits that make places inhabitable. An over indulgence in the consumption of nature for its aesthetic and sociocultural services can lead to the disruption of the intrinsic systems that sustain human life.

When considering these factors of environmental value, it can be argued that the pattern of suburban residential development that was discussed in the previous chapter clearly occurs simply for the aesthetic and sociocultural values that can humans can derive from nature. This model successfully ignores the impacts on the intrinsic values, which are arguably the most important. Haphazard suburban residential development can be held accountable for disruptions in natural system services that are now at the core of such problems as energy and resource shortages and climate change. Sprawling development, which can be characterized by large, ubiquitous lots with monotonous architectural styles, has promoted blameless ignorance and has become the image of the 'American Dream.' This type of residential development has allowed individuals to be

careless with the use of land and the destruction of natural resources, and has led to many significant environmental costs.

Additionally, suburban development allows individuals to become disconnected from the knowledge of the strain that is being placed on the Earth's carrying capacity. Few individuals recognize the negative impacts on local wildlife and vegetation that results from low-density residential development. In fact, the spread of suburban and exurban sprawl dramatically affect the health and diversity of natural communities. Land use, resource consumption and disposal of waste are some of the significant factors in the ecological footprint equation, which is a tool for measuring the impact of human behavior on the natural world that will be discussed more thoroughly in Chapter Four.

Many ecosystem services and processes are being permanently altered by residential development. In her book *Silent Spring,* Rachel Carson quotes Albert Schweitzer as saying, "man can hardly see the devils of his own creation."[7] These negative environmental impacts have been detected both in local environments as well in remote areas all around the world, which are seemingly removed from human influence. These impacts are damaging to the health and vitality of Earth's natural systems, wildlife and human existence. In fact, Charles Kilbert points out that "humankind is disturbing complex, naturally evolved, and diverse natural systems and is doing so in a fashion that can only result in catastrophe."[8] In order to understand the impacts on the inherent values of the natural environment by suburban development, the following sections discuss in greater detail the impact of this development pattern on land use and natural resources, water and air quality, native species, and the management of waste materials.

3.2 LAND USE & NATURAL RESOURCES

Trends in suburban residential development over the past fifty to seventy years have led to individuals and households sprawling themselves out further and further across the landscape, and inhabiting greater amounts of land per person. Recall the details of suburban growth presented in Chapter Two: that American land development has significantly exceeded population growth. This is concerning when considering the fact that this sprawling pattern of development consumes vast amounts of land that would have been otherwise undeveloped and utilized as land for agriculture or natural habitat for wildlife and other native species. (Figure 3.5) The first generation suburbs of the mid-1900's were developed on the fringes of urbanized areas of dense cities; these early suburbs still contained fairly small lots with modest-sized homes appropriate for the size of the families that were occupying them. However, as the demand for bigger houses, bigger yards and more seclusion extrapolated, second and third generation suburbs began developing on the fringes of what were the original suburbs. Because these new suburbs were developed farther from urbanized areas, green-fields and former agricultural lands were paved over to accommodate this growth. Green-fields are those areas of undeveloped, productive land either left untouched by humans or previously developed land which has returned to a more natural state. These green-fields are a functioning part of the local ecosystem and can also be enjoyed by their inherent natural beauty.

Many of the residents that are moving into the suburbs are arriving after houses have already been built and, therefore, are despicably unfamiliar with the natural resources that existed in the place where a manicured, manufactured landscape now

exists. Timothy Beatley noted that "many of the natural processes and cycles that sustain us, and that might provide visceral connections to place, are often hidden away from us, thanks to modern engineering and the tendency toward leveling and paving."[9] Suburban inhabitants are ignorant to the fact that the location of a newly constructed sprawling development was formerly agricultural land that accommodated the demand for food production to feed a growing U.S. population. Privacy fences shield the distant memory of a native forest that provided ecosystem services such as carbon sequestering and wildlife habitat. A wetland that removed toxins from freshwater supplies and controlled flooding has now been paved over to create the pathways that drain Sport Utility Vehicles from what were once thriving city centers and deposit them in driveways on the edges. According to *Sustainable Urbanism,* somewhere between ninety-five and ninety-seven percent of all land in the lower forty-eight states has been modified by Americans for various anthropocentric uses.[10] With this much of the natural environment altered for human use and consumption, it is no wonder that the intrinsic services of nature are nearly impossible to observe.

An endless number of ecosystem services are operating regardless of being acknowledged in order to help sustain human life on Earth. Dense development limits the potential for disrupting the natural environment because human impact is concentrated in smaller areas. Additionally, the demand for services and processes provided by nature is significantly decreased when it is shared among many in close proximity. However, in a sprawling suburban setting, much more opportunity for ecosystem disruption exists. In *Superbia!*, authors point out that in order to

accommodate just one suburban resident's needs, thirty-one acres of productive land from farms, fields and forests must be consumed or modified to generate the products and resources needed.[11] Additionally, for those natural services, like the availability of clean water and access to food, that do not exist in these far-flung green-field areas, more energy must be expelled in order to provide humans with sustenance. (Figure 3.6 through 3.7)

Here, the irony is that chief among the reasons for removing one's self and family from the ills of the city is the desire to be near nature—near its inherent benefits and beauty. However, this pattern of development results in a sort of slash-and-burn construction method that wipes out the very value of the land that existed in the first place.[12] As developers create artificial natural communities, the true, basic functions of the landscape that have been replaced are wiped out. These false environments provide no essential functions that support human life. As individuals attempt to move closer to the physical and psychological services that nature supplies, an artificial and ecologically insipid environment is actually created that has little connection to nature's most intrinsic functions. The average individual searching for a home in the suburbs is incredibly unlikely to be concerned for the natural elements of the site, such as the watershed, direction of sun and wind patterns and the native species local to the area. Cities seem to know no limit to development, especially ones imposed by the natural world. Each year, more and more productive land and forests are cleared, watersheds are drained, fossil fuels are burned, and other precious natural resources are harvested in order to support the construction of this model of development.

"In the United States, the construction and operation of the built environment consumes in excess of 30 percent of all energy and 40 percent of the materials produced by the economy."[13] If the impacts of clearing productive land for construction are not transparent, then certainly the impacts of the mining, producing, shipping and maintenance of all of the materials and products that build these settlements are virtually impossible to observe. Local land and resources are not the only assets that are impacted by this pattern of growth. Resources from around the world are produced for and sold to American consumers in order to support a materialistic lifestyle. In order to meet the demand for building materials for construction, many forests around the world have been stripped of their productive capacity. Exotic stones and woods are harvested and shipped from around the world to be transplanted into these ubiquitous environments with the goal of establishing one home's uniqueness and individuality from its neighbors. Foreign oils and other coal-based sources of energy are purchased in an increased quantity as the environments in which Americans are living become larger and, thus, more energy intensive to sustain. As the farms and productive lands that formerly produced food for the American population are paved over to create low-density neighborhoods, food is grown further and further from the point that it is consumed. This, again, creates a greater demand for energy to produce and ship the food that once could be grown nearby or even on site for one's own families.

The rate at which this haphazard growth is being constructed, consumed and replacing the basic functions of the natural environment has reached a level that is now unfeasible if there is any hope of sustaining an acceptable quality of life. Taking comfort

in the assumption that there is enough nature in other places to sustain high levels of consumption is foolish. When considering how much of the natural environment has been modified for human use, it is unreasonable to assume that the nature that has been preserved in parks and conservation areas has the capacity to support an unmodified pattern of development.

3.3 WATER & AIR QUALITY

The impact of a sprawling built environment effects water and air quality in many significant ways. As vegetative areas have been converted to impermeable surfaces and forests have been destroyed, issues with storm water management and flooding have become a chief concern for city planners and engineers. Many areas of agricultural land has been pushed beyond its productive capabilities; as the quantity and quality of cropland has been severely diminished, the productive capacity of the remaining land has been pushed to its maximum potential through the use of artificial, and often dangerous or deadly, chemicals. In her seminal work, *Silent Spring*, Rachel Carson brought the environmental movement to public awareness, pointing out that surface and subsurface waterways have become contaminated with a slew of synthetic materials that are impacting the health of the natural environment and causing a rise in chronic and fatal diseases in humans. Additionally, depleted 'carbon sinks' and increasing amounts of greenhouse gas emissions are jeopardizing air quality not only for polluted areas, but for their neighboring communities as well. (Figure 3.11)

The vast expanses of open space and vegetation that existed prior to human occupation of every habitable—and inhabitable—part of the United States provided natural filtration for resources such as air and water that are essential for human existence. However, as these natural systems have been removed, water and air quality issues have gotten so far out of hand that federal regulations have been enacted to help mitigate the impact on these precious resources. By removing natural communities, human civilization has converted natural, self-regulating processes into problems that require great energy and effort be expelled in order to control. Storm water is an excellent example of a process that was disrupted by human development and now is a major concern for many cities' public works departments. (Figures 3.8 & 3.10) Greater amounts of impervious surfaces are created by the development of sprawling areas. In fact, in *Sustainable Urbanism*, Douglas Farr points out that dense development produces significantly less runoff than low-density development due to less impervious surface area. When compared to development which contained one house per acre, a development with eight houses per acre reduced runoff by seventy-four percent.[14] Not only are more and larger rooftops created, but more roads are constructed to move individuals from their secluded homes to their activity centers. As of 2004, there were nearly 4 million linear miles of roadways and 43,480 square miles of blacktop for parking lots, driveways and other paved areas—this is an area nearly half the size of Indiana and is growing each year.[15]

Many of the modern residential developments contribute not only to issues of increased runoff, but also to other water management issues as well. More impervious

cover leads to increased flooding and the inability of ground water to recharge aquifers. In fact, many areas that have been converted to suburbs are essentially impervious surfaces, even if covered over with a grass lawn. When sites are developed, they are typically compacted in order to create a flat topography or unintentionally due to heavy construction equipment. This compaction prevents water from percolating through the soil, and increases flooding and impact on storm water systems. Additionally, this can cause problems with erosion, water quality and biodiversity. In fact, in one study, scientists and planners were able to show that by reducing much of the asphalt surface and planting thousands of trees, some of the runoff which leads to periodic flooding and pollution of water bodies could be reduced.[15]

However, the impacts of development on water and air quality are not just witnessed on the surface in the form of increased water run-off and more frequent flooding. As greater amounts of impervious surfaces are created, such as rooftops, roadways and parking lots, pollutants are appearing in more concentrated quantities in waterways. "By a strange paradox, most of the earth's abundant water is not usable for agriculture, industry, or human consumption…and so most of the world's population is either experiencing or is threatened with critical shortages."[17] Not only is vegetation crucial for helping control the amount of water that is available for human use, it is also important for removing pollutants from it in order to restore clean water supplies. One of the major sources of water pollution comes from the dangerous synthetic chemicals that are applied to lawns, landscaping and cropland in order to maximize their aesthetic and

productive qualities. In order to maintain the lifestyles that Americans have become accustomed to, many chemicals and synthetic products have been concocted.

Due to the diminishing acreage of productive land and natural resources, fertilizers are used on crops to yield maximum growing potential and support non-indigenous landscapes such as suburban lawns and exotic shrubs and flowers. Synthetic chemicals were produced in large quantities beginning in the 1940's. Since their introduction to the lawns of America, the number and potency of these chemicals has increased exponentially. These compounds do not exist in nature and thus cannot be cleansed out of the systems and controlled by natural systems. However, as Rachel Carson points out in her book, *Silent Spring*, these chemicals are used all over—on crops and gardens, homes, parks and natural areas such as forests.[18] These chemicals linger in waterways, soil and other processes with which humans come into contact. In an effort to control a few rogue weeds or insects, humans are exposed to a host of dangerous, even deadly, chemicals that can remain in natural resource sinks for generations.

The chemicals used on crops and lawns have found their way into human bodies, waterways, soil and air and are present in even the most remote natural areas. Waste products emitted from our homes pollute waterways and the ozone at an alarming rate. Forests, flora and fauna once formed unique communities that took the waste produced by human settlements and converted it to a useful product for other natural systems. However, the chemical makeup of these natural resources is now being permanently altered, which is leading to the excess buildup of pollutants and waste in water and air sources. But like many of the environmental impacts of the suburban lifestyle, these

effects go virtually unnoticed. The suburban landscape may seem picturesque. However, what aren't part of the snapshot are the downstream impacts on wildlife, the upstream cases of childhood asthma, obesity and cancer, and the cloud of pollutants that is forming right over Americans' ignorant heads. "Man, however much he may like to pretend the contrary, is part of nature. Can he escape a pollution that is now so thoroughly distributed throughout our world?"[19]

3.4 NATIVE SPECIES

Native species include both plant and animal life that are indigenous to a particular ecosystem or eco-region. Native plants and animals are critical because they are among the supporting services of nature that keep other ecosystem services operating and supporting human life. Examples of native species in the United States include the White Pine, Red Maple, and Oak trees that were abundant in early forests in the state of Indiana.[20] The Great Blue Heron that occupy nests in wetland areas[21] and Monarch butterflies that flutter through gardens and host plants in northern Texas[22] find homes in the natural communities of the United States. Each of these native species has a specific function in its environment and an intricate relationship with other species; they comprise and rely on resources of food, shelter and natural systems that are present in their immediate environment. . In particular, the first tropic level—the diversity of native plants—is important because these plants are able to convert the sun's energy into a form of energy that humans can consume. These plants are the only organism that can use that energy to feed human life. The second tropic level, which is comprised of native insects

and animals that eat and live among these plants, are dependent on the availability of a diverse and healthy community of native flora and fauna.

The impact of haphazard development is devastating on communities of native species. By removing areas of natural habitat, humans are unknowingly removing, disrupting and replacing very essential resources with artificial environments or alien species of plants and animals. Take, for example, bees and other insects that act as pollinators. These insects feed off of the plant species that are present and are busy transferring the seeds and pollen that establish new plant life. Without an appropriate quantity of the plants that comprise the first tropic level these insects do not have access to the basic resources for sustenance and, therefore, are unable to complete the cycle of pollination necessary to support a healthy plant community. Other insects and wildlife act as predators to the species that could wreak havoc on natural processes. Humans depend on these wildlife, insects and plants to provide some of the supporting services that this chapter highlighted. Without the function of these insects in various ecosystems, they are unable to produce new plant life for food, air and water filtration, or aesthetic value. Additionally, native predators cannot keep natural communities safe from pests and other insects that could carry disease and destruction because these local natural communities have not evolved to handle the negative impacts of these species.

In an effort to manufacture modern human settlements, in the form of suburbs, native plant and animal species have essentially been eliminated from the natural environment that existed before. The arrival of humans into wildlife's fragile habitat has pushed them into far-off places—tiny fragments of remaining habitat that will support

them until they experience the same ecological collapse that could be facing human civilizations. Douglas Tallamy calls to light an interesting attitude, that "our perception has always been that, no matter how many subdivisions we build, or how much land we put to the plow, or how many roads we construct, there will always be plenty of undisturbed space left."[23] When looking at a crabgrass lawn, it becomes difficult to believe that a diversity of plant and animal species used to call a barren area its natural habitat before the arrival of the bulldozer. However, as estimated by Tallamy, an amount of twice the size of the state of Indiana has been converted from natural habitat to non-native suburban lawns.[24] Scientists estimate that many of the plants and wildlife that are native to the United States are at a severe risk of becoming endangered or extinct. (Figure 3.12) Though scientists acknowledge that natural fluctuations in populations of species can occur, the trends that have been observed have displayed significant and abnormal decreases in the presence of some species.

In addition to the elimination of suitable habitats for native species, another critical harm to native plants and wildlife is the inability to compete with non-native species that are introduced into these already limited matrices of available habitat. Non-native species are both plants and wildlife that are transplanted into an ecosystem in which they did not naturally evolve. These species can sometimes be beautiful, in the case of exotic plants, but often require much more energy and effort to successfully grow. Additionally, non-native species can run rampant in an ecosystem that contains no predators or means of controlling their exponential growth. Invasive plants starve out resources from other plants and animals, altering native species' growing patterns and

eventually causing their extinction. Invasive insects have killed massive amounts of native tree and plant species. In *Nature-Friendly Communities*, the authors describe that "non-native species now make up about 5 percent of the total U.S. continental biota, and in some states almost 50 percent of the flora."[25] The perfectly manicured landscaping of these suburban lawns can be looked to as one of the critical inductions point for these disastrous invaders.

Between the impacts of exurban development and the introduction of alien species into natural environments, *Bringing Nature Home*, estimates that within most of our lifetimes nearly 95 percent of the plant and wildlife species that greeted the Pilgrims will be extinct.[26] Development will continue to pressure the viability of native species and wildlife habitats. Most of the areas that were flat, cheap and easy to develop have virtually all been developed and inhabited. Now, development is moving into more ecologically diverse areas that are harder to develop, and which afforded refuge for the remaining, struggling populations of these species. And like natural resources, the impacts of this development aren't only driving domestic species to extinction, but are also impacting species and their habitats around the globe. In order to construct a new suburb, a native forest might be clear cut and flattened for the construction of homes. However, the lumber removed from the site is rarely used to construct the new units. Instead, construction materials come from the forests overseas that are dangerously close to being overharvested. Very rarely are the intricate connections of the natural world and impacts of this development obvious, but the mark of American suburban development can be seen around the world.

3.5 WASTE PRODUCTION

In addition to the taking of more and more land and natural resources to be altered for human benefit, an unprecedented amount of waste has also been generated. This waste is causing yet another set of concerns impacting the health and vitality of the natural environment and human well being. Author Douglas Farr explains that "modern consumer society, for instance, exploits natural resources at a rate that the Earth cannot sustain. Our appetite for petroleum, electricity, mobility, indoor living space and material goods is enormous and unrelenting."[27] Raw materials and energy are wasted in the process of harvesting hard to reach natural resources. Synthetic chemicals and materials are created to meet the needs of human lifestyles but are unable to be broken down by the processes of the natural environment. Heaps of garbage are shipped out of sight only to leach contaminants into waterways and native species' habitats. And finally, consumption of fossil fuels and is leading to dangerous accumulations of greenhouse gases in the atmosphere. Considering the fact that most human waste is not able to be converted to food or a resource for another species, brings to light the need for a more transparent system of consumption and disposal of waste. All other species' waste is able to fuel another species' needs. In order to strengthen human's connection to natural systems, the impacts of uncontrolled consumption need to be made more visible.

In an article for *Forum Journal*, which is the journal for the National Trust for Historic Preservation, Carl Elefante argues that the most sustainable building is the one that has already been built.[28] The materials for its construction have already been harvested, produced, shipped and assembled into a structure that is usable for human

needs. Building new suburban developments would include a duplication of the process and resources associated with an aging housing stock that generally seems to be overlooked and uncared for. Flight to the urban fringes has left many historic city centers, and their once-thriving inner-city neighborhoods, abandoned. When significant vacancies lead to noticeable blight and disrepair, many communities resorted to the deconstruction of these structures, sending their components to landfills in the form of waste and building new models at the periphery of the city.

As more and more new units are constructed, the demand for the materials that comprise them increases. The impacts of modern built environments are already great, as many of the natural resources that are harvested for building are already endangered. The search for viable materials for constructing residential American communities is commencing further and further into hard to reach areas of natural resources—which causes resource consumption to become much more intensive. Because raw materials for building are becoming harder to find and reach, many other natural resources become waste products of the very process of harvesting itself. Water, land, oil and other natural resources are consumed and wasted in an effort to reach these raw materials and transform them into usable products for building consumptive lifestyles. The process of consumption and waste is compounding itself as cities grow further and further from their centers.

In some instances, the impacts of development cause the land itself to become unusable. By taking more and more land for the building of suburban neighborhoods, less productive land is available for growing food and other resources. The demand that

is placed on remaining cropland to produce food for a growing population is addressed by using artificial chemicals and fertilizers as was mentioned in the previous section. Compromised natural resources and single-crop communities are highly susceptible to famine by disease or pests. Chemical solutions cause permanent alterations to the soil and place a great amount of stress on the viability of land for productivity. Many crop fields lose their productive capacity all together due to being unable to recover from the pressure placed on it. If poisoning by fertilizers or other synthetic materials becomes too great, these lands can become off-limit for any type of human development and are unable to support natural life.

The construction process itself also wastes many beneficial natural products and resource from the land that is being developed. Rather than engaging in careful construction methods that reduce the impact to the land and existing vegetation of a particular area, many development sites are completely stripped of all trees and plant life and left to lie barren for long periods of time until paved and constructed. As William Marsh notes in *Landscape Planning*, this leaves the soil exposed to the elements, and wind and water can carry away much of the soil and its productive nutrients when it is left unprotected.[29] Eventually these sites are covered over with pavement and artificial, non-native turf that, again, need large quantities of water and fertilizers to grow.

A critical land use issue in many cities today is the creation of solid waste products and its transfer into managed waste disposal sites. Many of the man-made products that are used to assemble a consumer's lifestyle are quickly discarded and left to reside in landfills and other areas of waste collection for long periods of time. As is

highlighted in the short film, *The Story of Stuff* the social and ecological impacts of this waste far outweigh the value and lifetime of the products that were created in the first place.[30] Cheaply constructed homes and the products that are placed in them are driving a culture in which sending things to a landfill and purchasing new is not uncommon and, in some instances, even novel. Products, systems and communities have not been designed for deconstruction, reconfiguration and reuse. Rather, these elements and the American economy have been designed to meet short-term needs and to be completely repaved to meet the next set of demands.

The disposal of waste raises many concerns over the use of land for the other valuable resources of nature. For instance, not only are individuals concerned with the potential for leachate from garbage to contaminate soil and groundwater, but also with landfills' impacts on the aesthetic and sociocultural values of nature. Landfills are viewed as an undesirable land use that negatively impacts the beauty and desirability of a place. Often, there are many economic considerations, such as the inability of land to be used again for other productive purposes or the decrease in property values in areas immediately surrounding a landfill. Not only do disposal sites accommodate the waste produced by consumers, but are also considered to be a waste of land and productive capacity themselves.

A final source of waste is the environmental pollution that results simply by residing in the sprawling expanses of the suburbs. This pollution not only takes the form of soil, surface water and ground water contamination that have already been discussed. It also includes the greenhouse gas pollution that is a result of the energy-intensive

lifestyle that goes hand-in-hand with life in a sprawling community. Because suburban and sprawling development relies on Euclidean Zoning principles of separated land uses, driving becomes necessary for even the most basic of daily tasks. Living on the periphery of cities results in a high consumption of energy and an equivalently high emission of greenhouse gasses. Housing units with larger building footprints inherently require more energy to operate and sustain. Areas with insufficient quantities of vegetation and natural communities are unable to filter carbon dioxide from the environment before it is able to concentrate in dangerous quantities in the atmosphere.

In fact, as more developed areas of the United States have sprawled, this phenomenon has been expounded. The United States boasts only approximately five percent of the world's population, but is responsible for almost twenty-five percent of the world's energy use.[31] And there is simply not enough productive capacity available on Earth to supply the resources needed and accommodate the wastes produced by the modern suburban residential model of development. Residents of the United States—particularly those in suburbs—are not held responsible for the environmental, social or economic costs of these lifestyle choices. This place-destructive pattern of development hides the short and long-term ecological impacts of sprawling places.

3.6 THE ECOLOGICAL FOOTPRINT OF THE SUBURBS

One concern driving the environmental and community sustainability movement is the idea that the residents of industrialized countries, particularly the United States, are

living in overshoot—living above the productive means of the Earth's natural capital. Authors of *Our Ecological Footprint* shed light on this issue by point out that "the premise that human society is a subsystem of the ecosphere, that human beings are embedded in nature, is so simple that it is generally overlooked or dismissed as too obvious to be relevant."[32] But, as has been demonstrated in this chapter, the impact of residing in resource intensive communities, and engaging in the associated lifestyles, is causing significant damage to the inherent, aesthetic and sociocultural benefits of nature. However, American consumers live in a society where the ecological consequences of suburban lifestyles are exported, essentially freeing individuals from any sense of responsibility for the ecological disruptions that are being experienced. After all, ignorance is bliss.

Again, the reality is that in the United States individuals and communities have an ecological footprint that cannot be supported by the Earth's available resources. An ecological footprint is a figure which estimates the amount of productive land that is necessary to provide the energy and materials needed to support the economic, social and ecological activities of individuals and communities. Determining the amount and sources of the goods, services and energy that supports the American lifestyle is a complicated task. This is due to the fact that many of the products and processes that individuals have come to depend on come from around the globe and from many different cultures. Americans have created figurative big shoes to fill with products and resources in order to accommodate the demands of a large and far-reaching ecological footprint. The summation of all of the impacts of a sprawling built environment that have

been discussed thus far are some of the critical components that are analyzed in the ecological footprint equation; other factors include where goods and services are purchased, what kind of food is consumed and where it comes from, and personal decisions regarding transportation and the disposal of solid waste.

By examining the ecological footprint of suburban communities, it is evident that the demand for goods, products and services of the natural environment are vastly exceeding the Earth's ability to supply them. The Global Footprint Network monitors the delicate balance between the Earth's 'budget' of natural resources and the 'spending' of its citizens worldwide. According to their website, global resources use has exceeded the Earth's capacity to produce the resources needed each year since the 1970's; in 2010, the Earth was operating in overshoot starting on August 21.[33] Because individuals are so far removed from the impacts of this 'take-make-waste' system, many are totally unaware that residential communities are using resources faster than the Earth's ability to replenish them. (Figures 3.13 & 3.14)

The ability to recognize that individuals and communities are surviving off of resources that are not available is masked by the ability of modern technology to stretch resources farther and farther from their natural state. Technology has engineered a false estimate of human carrying capacity that is leading to an unacceptable rate of consumption. According to Wackernagel and Rees in *Our Ecological Footprint,* "carrying capacity is usually defined as the maximum population of a given species that can be supported indefinitely in a specified habitat without permanently impairing the productivity of that habitat."[34] This definition, however, seems to be inapplicable to

human carrying capacity due to the ability of technology to create innovations that overcome the natural limits of nature. It is important that the exponential rate of growth and consumption be reined in. Modern society needs to be aware that the sum of land area and natural resources demanded for supporting human existence must be smaller than the sum of the land and resources available for consumption.

The lessons of past societies, like Easter Island, that experienced collapse due to their inability to recognize the limits of carrying capacity should influence better decision-making in modern settlements. Many civilizations have grown beyond the productive means of energy, water and food supplies. One critical problem is the inability to recognize what comprises a sustainable rate of consumption. Simply because developable land exists, even if this means that intense amounts of energy and resources have to be expended in order to develop it, doesn't mean that humans should inhabit it. The existence of seemingly abundant amounts of trees and other forest products doesn't mean that they should all be harvested for the lumber industry. What has become evident is that nature's value is not witnessed at face value, and without some level of preservation and conservation modern societies could be dangerously close to their own collapse—much like those obsolete societies discussed in Jared Diamond's book.

What also must be taken into consideration is that the more land and natural resources are harvested and consumed now, the fewer are available for future generations. Ensuring an acceptable supply of resources and quality of life within this generation is only half of the battle. In addition to the various ways of valuing nature that were discussed earlier in this chapter, humans need to adopt a set of environmental ethics

that expand their decision-making process beyond individual, self-gratifying motives. Developing prestigious sprawling neighborhoods results in greater personal wealth, but leads to social disparities when the availability of resources are starved away from other members of the same community as well as civilizations around the globe. And finally, a selfish taking of natural products and systems has a profound impact on the plant and wildlife species that are competing with humans over those same resources for survival. The choices that are made about the communities in which Americans will live are not just impacting neighborhoods in the present day, but more significantly are affecting citizens all around the world and for generations to come.

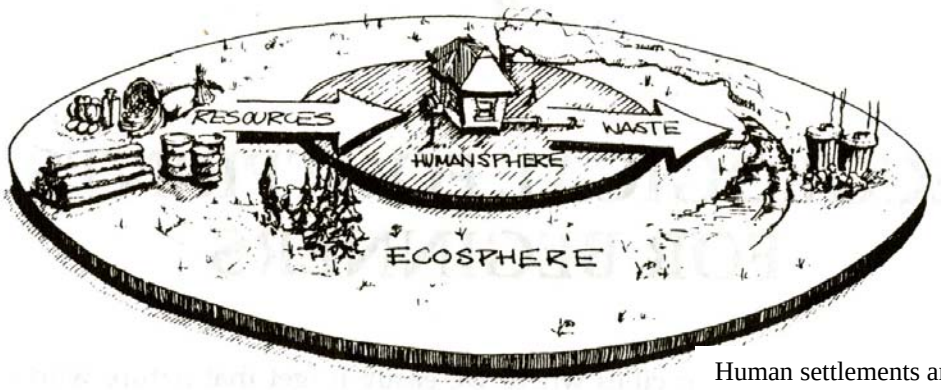
In order to understand and mitigate negative impacts on the natural world through the development of residential communities, it is important to first understand that humans are a part of the natural world and its processes rather than in control of it. Individuals need to learn that in order to be considerate dwellers within the natural environment, "the crucial and perhaps only and all-encompassing task is to understand place, the immediate specific place where we live."[35] This includes an understanding of the limitations of the natural processes and systems of built environments. This understanding can be shaped by the simple knowledge of what geological and biological features used to be in place, and how this affected the social, economic and physical arrangements of earlier civilizations. However, understanding the immediate surrounding is only one important step; it is also crucial to understand that each place is intricately connected to many, and quite possibly most, other places and rely on them for many of the biological, social and economic functions that are necessary for supporting life in a

community. What is done in local communities has impacts on ones all around the world.

The lifestyle that has been fabricated since the early and mid 1900's is now becoming incredibly difficult and costly to maintain—both in terms of upfront monetary costs as well as the long-term ecological ones. Authors of *Superbia!* Believe that "the American Dream has reached the point of diminishing returns. The costs of high living are out of control and are disrupting personal heath, family closeness, community vigor, and economic and environmental stability."[36] In order to avoid the demise that collapsed cultures experienced, humans must reevaluate the impacts that consumption has on natural environments and the planet as a whole. It is now time to reestablish connections with the natural environment and its effects on civilization, and determine a model for survival that is more sustainable and will ensure human's continued existence on the planet—not only for those currently residing in the United States, but for civilizations around the world and for future generations.

It is incredibly difficult to imagine a country that is capable of going backwards from this sprawling, intensive pattern of development and consumption. Witnessing flight from the suburbs back into the cities, and other dense communities, is something that is unlikely to occur at any point within this lifetime. In fact, many believe that green-fields are the likely location for new development for the foreseeable future. Therefore, developing a model that can help rectify some of the negative impacts of existing and future residential communities is an important starting point. Author Timothy Beatley reminds the designers and planners of new residential communities that

sustainability challenges are going to require individuals to be more cautious about the impacts of consumption, resource extraction and ecosystem disruption.[37] A more sustainable model for retrofitting the suburbs and reconnecting their inhabitants with the natural world in a comfortable and aesthetically pleasing way is a significant challenge, but one that is critical and pressing if we hope to regain harmony with the natural processes that have already spiraled out of control.



Human settlements and lifestyle are subcomponents of the natural environment and generate significant impacts on the natural processes and resources of ecosystems. (Top to bottom)

Figure 3.1: *Wackernagel and Rees. Our Ecological Footprint: Reducing Human Impact on Earth.* p 8.

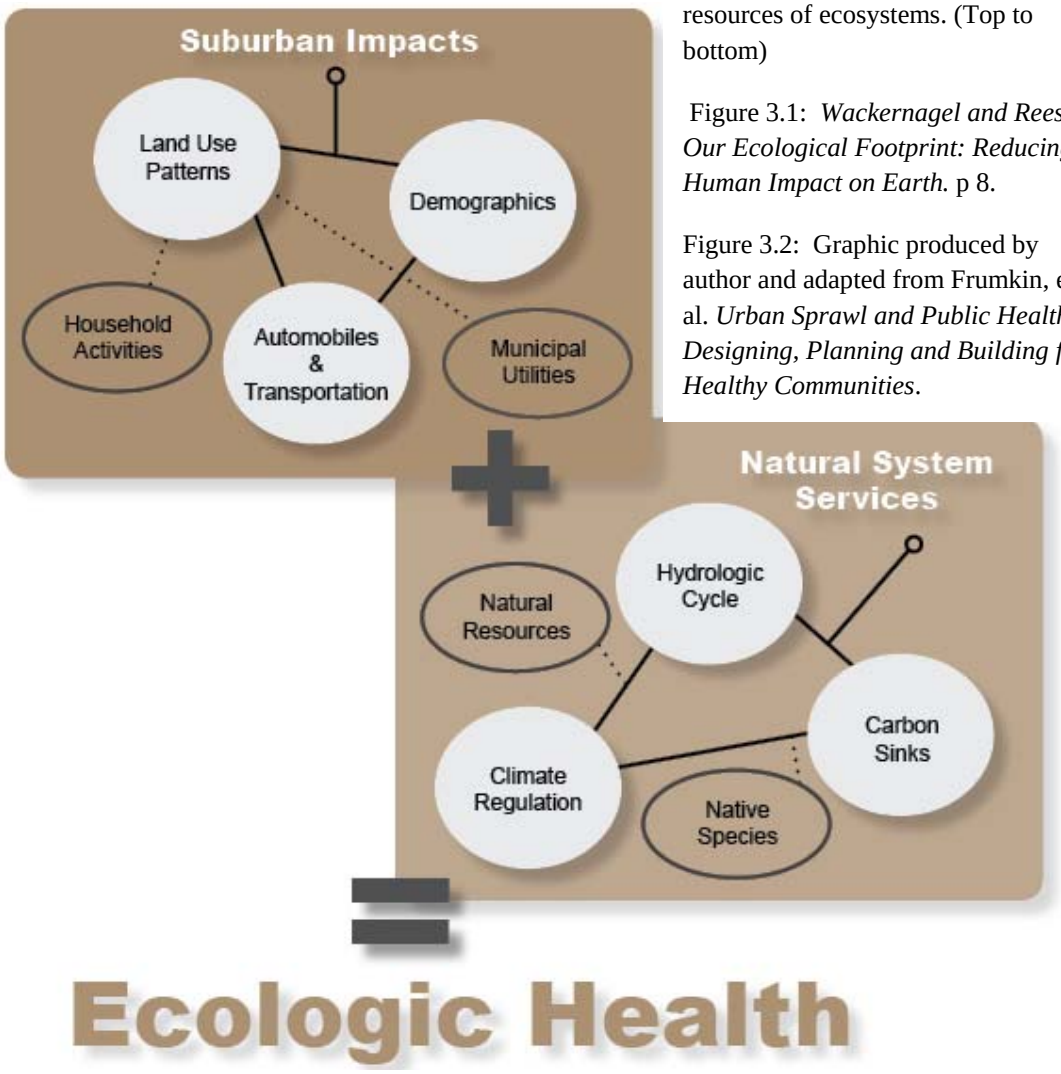


Figure 3.2: Graphic produced by author and adapted from Frumkin, et. al. *Urban Sprawl and Public Health: Designing, Planning and Building for Healthy Communities*.

Table 2.2. Services provided by systems to human settlements

Air quality enhancement/maintenance
Soils for food, wood, and paper production
Ambient temperature enhancement/maintenance (hot weather moderation)
Dampening flood peaks
Filtering and recharging groundwater
Reduced urban-chimney effects
Erosion control (cover, slope component, rainfall, wind, and soil texture components)
Renewable energy sources (solar, wind, biomass, geothermal, tidal)
Tree, bush, and flower pollination
Albedo change forces (energy budget for plants and animals)
Providing evapotranspiration cooling and shade for animals, people, and buildings
Food and water for wildlife
Dampening vertebrate pest damage to crops and other land production
Recreational and tourism areas and area access
Grazing for domesticated animals
Providing noise barriers and separation
Natural fires (for secondary succession conditions)
Carbon, energy, and water storage
Hazard reductions of several types

Figure 3.3: Services provided by the natural environment to human settlements. *Source: Kilbert. Reshaping the Built Environment: Ecology, Ethics and Economics.*

Table 3.1. A typology of values of biophilia

Aesthetic: physical attraction and appeal of nature
Dominionistic: mastery and control of nature
Humanistic: emotional bonding with nature
Naturalistic: exploration and discovery of nature
Moralistic: moral and spiritual relation to nature
Negativistic: fear and aversion of nature
Scientific: knowledge and understanding of nature
Symbolic: nature as a source of language and imagination
Utilitarian: nature as a source of material and physical reward

Figure 3.4: Values that individuals place on the resources of the natural world. *Source: Kilbert. Reshaping the Built Environment: Ecology, Ethics and Economics.*

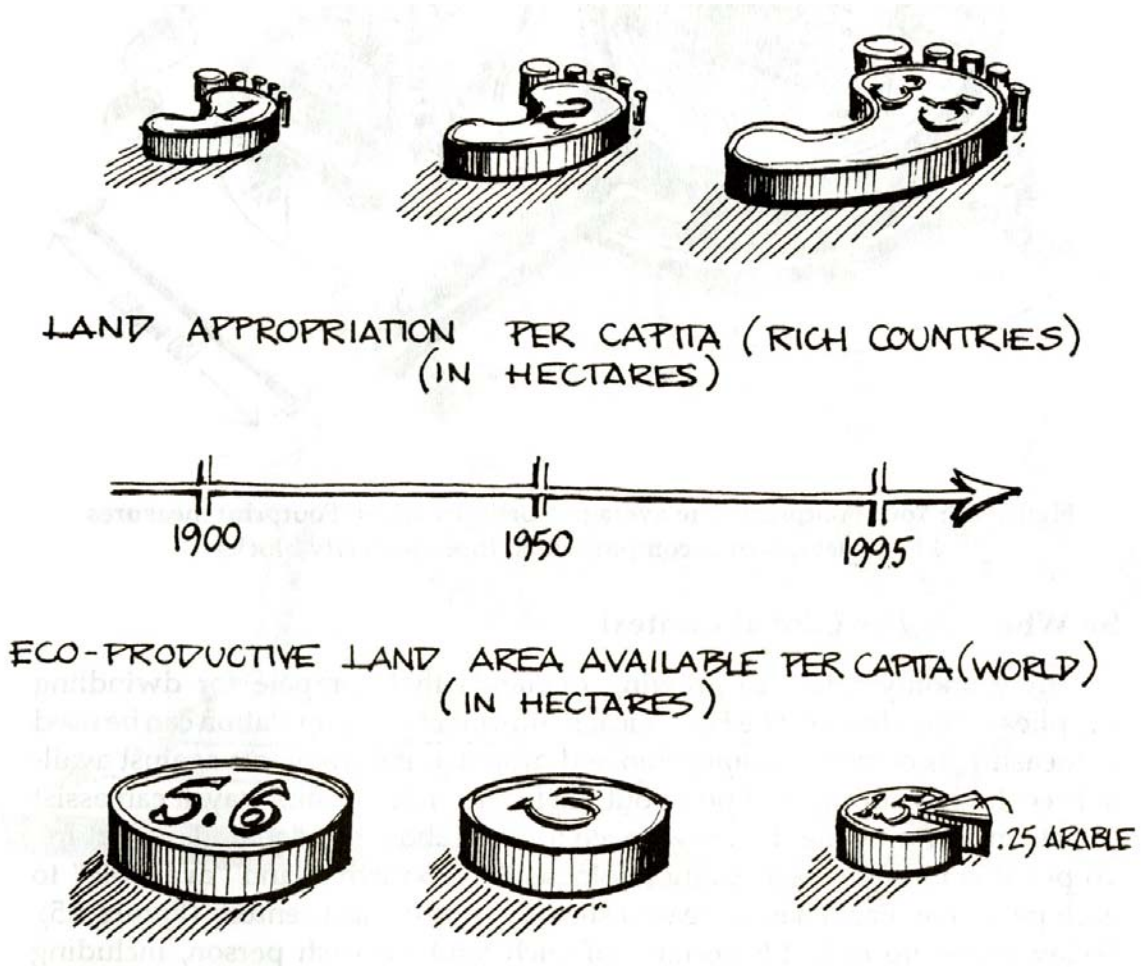


Figure 3.5: Humans are sprawling themselves out over the landscape and occupying more land per person; this sprawl significantly reduces the amount of productive land and resources that are available to support human life. As early as the 1970's human settlements were already consuming land and resources above their means. *Source: Wackernagel & Rees. Our Ecological Footprint: Reducing Human Impact on Earth*. p 14.

*Note: One hectare is equal to 2.471 acres. Therefore, land appropriation per person in 1995 (according to source) would have been equal to 7.431 to 12.355 acres; the eco-productive land available would have been 3.707 acres, with arable land at 0.618 acres.

Comparison of Environmental Transect Performance		
Design Context	**Urban**	**Suburban**
Residential Density (net DU/acre)	35	0.2
Open Space (% of total land area)	5	20
Employment Proximity (jobs within 1 mi)	30,000	10
Street Density (centerline mi. per sq.mi.)	1	25
Transit Proximity (avg. ft from DU to nearest stop)	400	25,000
Auto Use (total VMT/capita/day)	10	35
Environmental Performance	**Urban**	**Suburban**
Land Consumption (gross acres/capita)	0.01	10
Water Consumption (gal/capita/day)	50	200
Energy Use (MMBtu/capita/year)	100	200
Imperviousness (impervious ac/DU)	0.03	0.2
Non-point Source Pollutants (kg/capita/year)	0.01	0.04
Criteria Air Pollutants (lbs/capita/year)	200	800
Greenhouse Gases (tons/capita/year)	4	12

Figure 3.6: Land and resource consumption of suburban context as compared to urban context. Adapted from *Farr, Douglas. "Comparison of Environmental Transect Performance of Sacremento, CA" from Sustainable Urbanism: Urban Design with Nature.*

Table 1.1: Land Required to Meet the Needs of One Suburban Resident

CATEGORY	ACRES/PERSON
Energy	18.9
Timber	3.5
Food	6.2
Accommodating roads, houses, and other infrastructure	2.5
Total	31.1

Source: "A Step Ahead," University of Wisconsin website: <www.madisonfootprint.org/sustain/action.html>.

Figure 3.7: Productive land needed to support suburban residents. *Source: Chiras and Wann. Superbia! 31 Ways to Create Sustainable Urban Neighborhoods.*

Water Impacts and Housing Density					
One-Acre Level: Different densities developed on one acre					
Scenario	**# acres developed**	**% Impervious cover**	**Total Run-off (ft/yr)**	**Run-off/unit (ft/yr)**	**% Savings over one house/acre runoff per unit**
A: One house per acre	1	20	18,700	18,700	0
B: Four houses per acre	1	38	24,800	6,200	67
C: Eight houses per acre	1	65	39,600	4,950	74

Figure 3.8: Impacts of low-density development versus clustered development on environmental issues such as storm water run-off. Adapted from *Farr, Douglas. Sustainable Urbanism: Urban Design with Nature*.

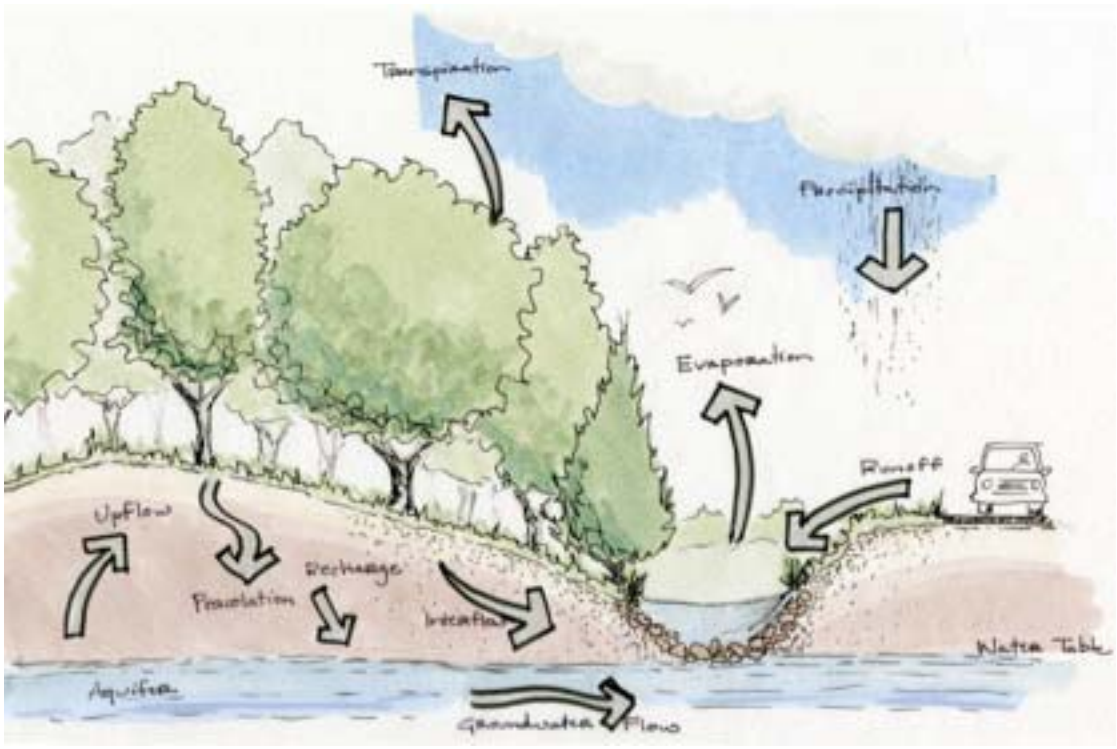


Figure 3.9: Hydrological Cycle. *Source: Sketch by Author.*

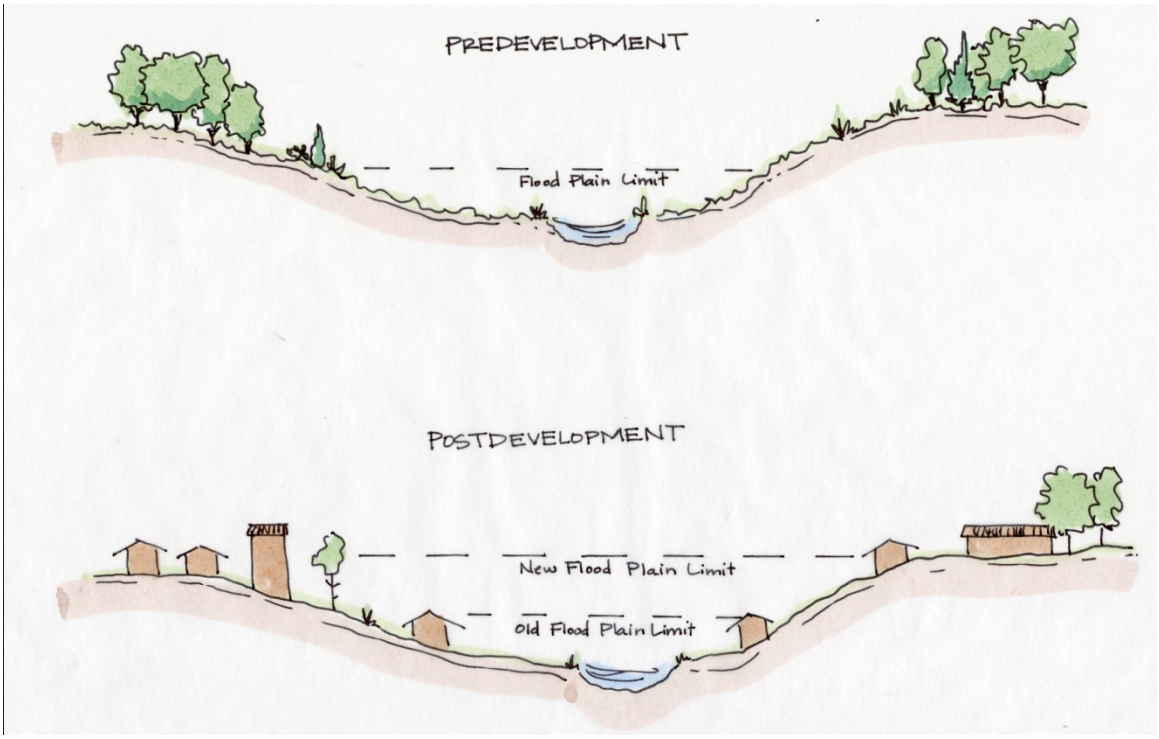


Figure 3.10: Impacts of development on environmental issues such as flood plain capacity. *Source: Sketch by Author.*

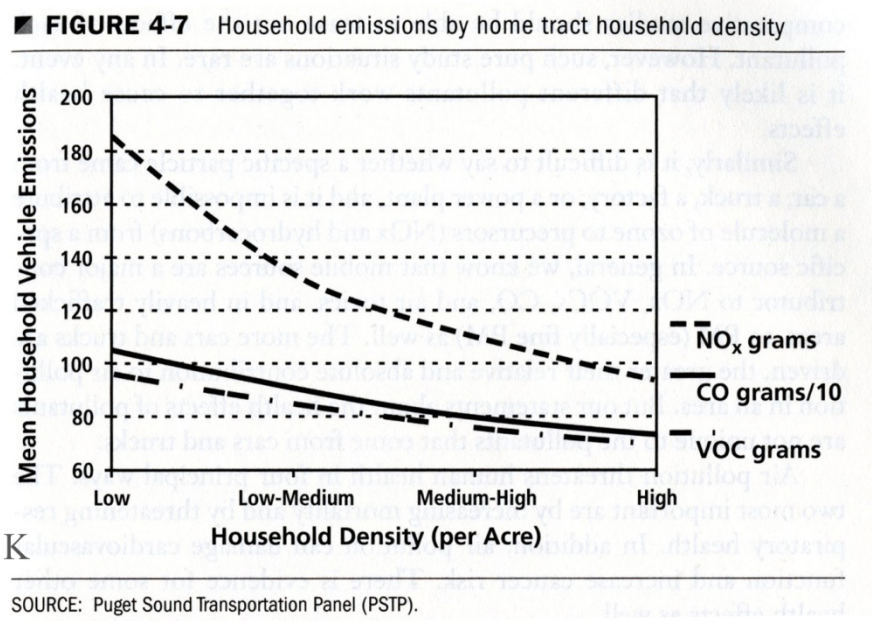


Figure 3.11: Sprawling development leads to increased vehicular car trips, which increases vehicular emissions. *Source: Frumkin, et. al. Urban Sprawl and Public Health: Designing, Planning and Building for Healthy Communities*. p 79

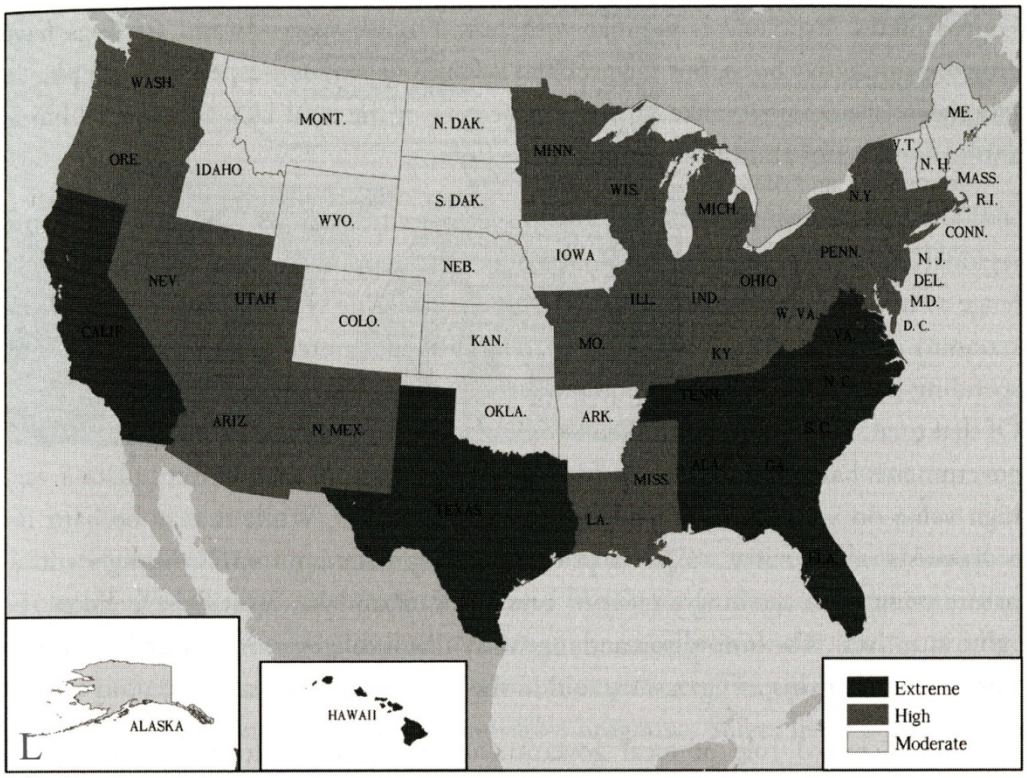


Figure 3.12: Native Wildlife species endangerment due to development. *Source: Duerksen & Snyder. Nature-Friendly Communities: Habitat Protection and Land Use Planning*. p 3

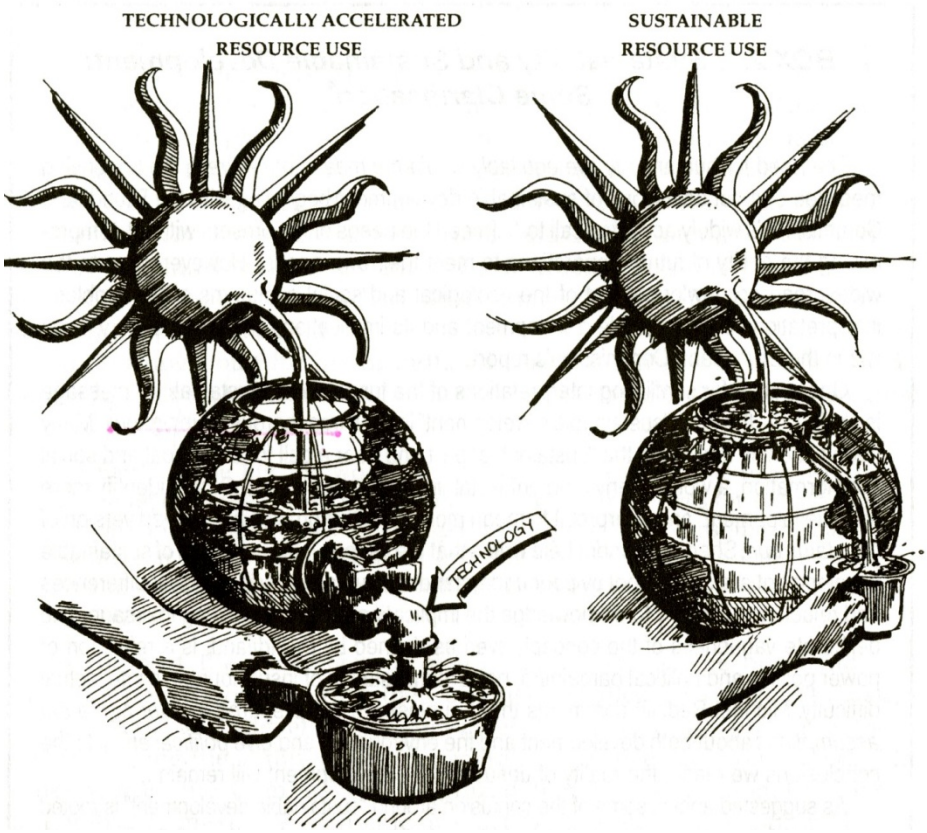


Figure 3.13: Technology is allowing Earth's natural capital to be eroded faster than it can be regenerated. *Source: Wackernagel & Rees. Our Ecological Footprint: Reducing Human Impact on Earth*, p 34.

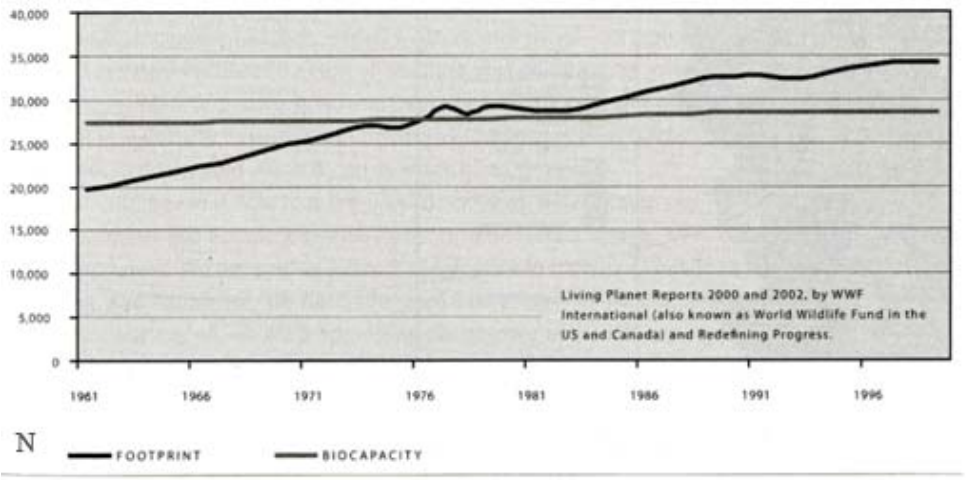


Figure 3.14: Consumption has been exceeding a sustainable rate consistently since the 1970's. *Source: Farr, Douglas. Sustainable Urbanism: Urban Design with Nature*, p 23.

CHAPTER FOUR **LIVING LIGHTLY: CASE STUDIES OF SINGLE-FAMILY RESIDENTIAL SUSTAINABILITY**

"Conservation means development as much as it does protection.

I recognize the right and duty of this generation to develop

and use the natural resources of our land;

but I do not recognize the right to waste them, or to rob,

by wasteful use, the generations that come after us. –Theodore Roosevelt, 1910"[1]

4.1 DEFINING SUSTAINABILITY

Chapters Two and Three highlight the many factors that have allowed individuals to view each piece of the built environment as an independent component, and physically isolate them into pockets of form and function. However, cities are much more than a series of buildings and individual pieces. Cities are a collection of interconnected systems that support living, working and playing, which shape the built environment. The impacts of careless development have been engineered out of sight until recently, and cities have sprawled due to a disregard for these systems and their relationship with energy use and environmental consequences. The negative consequences of highly consumptive behavior and settlements are finally starting to reach a level that can no longer be ignored—many of them at a global scale. Some believe that energy policy and resource reform will help increase awareness of these issues and return human settlements to more compact, resource conservative models.

Mitigating the impacts of the uncontrolled explosion of suburban growth in the United States is crucial if humans are to be confident in the sustainability of the planet for future generations. Scaling back this anthropocentric development will require a comprehensive effort on the part of all individuals that are involved with the planning, design, construction and inhabitation of our residential communities. Rather than seeing homes, and the neighborhoods in which they exist, as solitary places exempt from social and environmental matters, it is important to understand that these places are intricately connected to other places and people. The concept of a home or a residential settlement needs to include an understanding of historical, biophysical and anthropocentric

connections. Homes and the places which support settlements should be shaped and defined by natural influences which support human life, rather than by arbitrary political and social boundaries.

New models of development will need to take into consideration this myriad of environmental concerns before the first acre of ground is broken; existing suburbs will need to be retrofitted in such a way to avoid further damage to ecological systems. (Figures 4.2 & 4.3) Some would argue that the return to the cities and dense urban centers is the solution to current and future ecological, economic and social hardships. However, suburbs and sprawling places already exist. The disassembly of these places would be an environmental nightmare as the embodied energy, resources and waste has already been expelled in order to construct them. Therefore, in order to embrace sustainability in American communities, reforming the suburban areas is of chief concern. In fact, some experts in sustainable community development believe that urbanizing the suburbs will be the next development challenge for residential designers and builders. Additionally, preservationists concerned with issues of sustainability have suggested that the scope for building conservation be expanded to include much more of the housing stock that exists, rather than eliminating it for the sake of new development.[2]

The information presented in Chapter Three leaves no doubt that the suburbs need an ecological 'face-lift.' Determining the steps that are needed to make these areas more sustainable is no easy feat, particularly because sustainability is an incredibly difficult concept to define. Sustainable development can be defined as "development that meets the needs of the present without compromising the ability of future generations to meet

their own needs."[3] This means accepting the limits of nature and adapting the built environment to operate within these limitations, rather than engineering systems that allow individuals to move beyond those limits and erode the natural capital of the Earth. Wackernagel and Rees describe natural capital in *Our Ecological Footprint* as the natural assets that produce a quantity of goods and services that last for some time into the future.[4] This natural capital includes not only the renewable and non-renewable resources that are clearly consumed, also includes the processes and other ecosystem services that were discussed in Chapter Three that support human life.

As was discussed near the end of Chapter Three, sustainability does not refer only to ecological and environmental issues, but also to economics and matters of social justice. If the suburbs are to become truly sustainable, the planning, design, construction, inhabitation, and reform of these places must acknowledge that these residential units are not one individual component, but are part of a much greater web of processes, systems and interactions. They must not compromise the quality of life of other human and non-human species, natural systems, civilizations or future generations. Residential communities must have the ability to sustain themselves for long periods of time, and meet the needs of their inhabitants while simultaneously mitigating negative environmental impacts.

This is certainly a difficult challenge that will require much hard work, education and an overhaul of lifestyles. It is important to remember, however, that living sustainably is not a new phenomenon, but rather, a forgotten one. Communities used to be very much in touch with natural processes, and the scale at which these built

environments were composed is evidence of this. With advances in the industrial revolution and technology Americans have expanded settlements well beyond the means of the natural environment. Charles Kilbert points out that the most significant challenge to incorporating sustainability into our residential communities will be to "restore in the built environment all our tattered valuational connections with healthy natural process diversity."[5] Kilbert goes on to explain that this challenge is complex because there are many scenarios of sustainability that need to be implemented in residential communities in order to ensure an acceptable quality of life. These include recognizing the ecological impacts of individual household decisions, lifestyles of entire neighborhoods and communities, and the far-off impacts on various ecosystems and natural processes. Continuing to internalize decisions and behaviors regarding the use of energy and natural resources will result in an increasing long-term cost to natural communities and humanity as a whole. Sustainability needs to be implemented simultaneously at the household, neighborhood and global levels.

Green design and sustainability initiatives are not issues that ordinary citizens are unaware of. In fact, whether or not individuals understand the implications of these issues, the terms 'green' and 'sustainability' have become 'sound bites' in the early twenty-first century media culture. The more pressing concern is making citizens aware of why these issues have become so important and how they can be embraced at these various levels. Individual households need to recognize ways in which energy and resources are over-consumed and work to reduce them. These include, among many other things, the utilization of alternative energy systems, scaling back energy

consumption and reducing household wastes—especially those that are not recyclable. Potential homeowners need to be aware of the resource implications of new construction versus an existing unit or rehabilitation, and a home's proximity to the resources and daily activities that will be necessary to sustain life. Neighborhoods and communities can utilize local resources and services, find ways to share waste products as productive resources for other processes, engage in the local economy and establish shared community open spaces and natural areas. Around the world, individuals and communities need to evaluate their ecological footprints and identify strategies for mitigating and rectifying the negative impacts on the world's environmental systems.

Strategies for sustainability not only need to be implemented at various levels and within various systems, but also need to be encouraged by a triad of influences. The first is political leadership. Conservation, preservation and sustainability regulations have been met with mixed success in terms of their implementation and effectiveness. However, strong federal, state and local regulations are important in order for a sustainability movement to be supported. This is especially important for reaching those individuals and organizations that value nature purely for its sociocultural and economic products and disregard its inherent processes and services. Grassroots efforts to build sustainability must also gain momentum so that individuals feel truly engaged in an issue and are more willing to learn about the issues and participate in the lifestyle modifications that are necessary. Finally, individual and personal commitments to embracing environmental values and ethics will be necessary for people to truly care and reconnect to a place. The combined efforts of these three movements will help to

reestablish connections with the vital network of systems that support human settlements. (Figure 4.1)

Although it is important to consider sustainability at many scales and supported by various influences, this work will focus on retrofitting single-family residential neighborhoods that have already been constructed. More specifically, the design component will focus on the transformation of one small residential lot. There are many strategies available for retrofitting these sprawling, energy-intensive places. Some of these strategies include, but certainly are not limited to, the concepts outlined in the following paragraphs.

The first important strategy for improving the sustainability of residential areas is to work towards the control of sprawl. It has already been demonstrated that much of the cheap, easy-to-develop green-field areas have already been converted to suburban neighborhoods. However, it is important to place boundaries—be they physical, political or otherwise—on the fringes of our communities to keep them from growing at a more outrageous and haphazard pace into the yet untouched places. Land use strategies that place emphasis on the containment of sprawl and the infill of low-density development will help to strengthen existing places, and will help mitigate the ecological impacts of future development.

In areas where land use regulations can not strictly control new and sprawling development, residential design should consider the preservation and conservation of the natural environment in any way possible. This includes designing individual units, and their supporting infrastructure, in a way that works with nature's processes and systems,

and prevents significant burden on them. Designing with nature in mind, and mitigating human's destruction of it, would ensure that residential communities are embracing the values that earlier suburbs were attempting to connect with—rejoining nature in a way that is beneficial to the health and sustainability of human life. This model of development would need to be embarked upon carefully, as much understanding of the history and ecology of a particular place would be critical. Proposing development in a particular place should include an analysis of the resource impacts for the development itself, its impact on native wildlife and an understanding of the health and condition of resources all around the world and for future generations.

Additional strategies for sustainable residential development include those in which energy consumption, resource inputs and waste production are minimized by the use of natural systems and renewable resources. Prior to development, understanding the limits of the natural environment in a particular place will determine the ability of a particular residential area to utilize local materials and renewable sources of energy. Any new residential developments should be designed and constructed with energy efficiency and sustainable building techniques as the leading determinants of the form and function of new structures. Construction should consider the entire life cycle of a building, rather than only its upfront costs. Recycled and recyclable materials should be used whenever possible. Technologies and systems should be implemented to improve energy conservation and cut down on energy consumption. Reducing the need for inputs into the structures will also help cut energy consumption to a minimal level that could be satisfied through on-site generation of energy.

These new structures, and the collection of them into neighborhoods and residential communities, should utilize the available natural systems and local resources for sustenance. This includes infrastructure such as bioswales, permeable paving and rainwater harvesting for ensuring clean, renewable sources of potable water. Solar or wind technologies should capture available natural energy for converting to electricity for light and heat. The form and orientation of structures should utilize sun and wind for passive services such as day lighting, heat and ventilation. Entire neighborhoods could work to share resources, rather than competing for them, and could develop a system in which one household's waste could become the fuel for another household's energy or resource needs. Additionally, open spaces, natural vegetation, and areas for gardening or supporting wildlife habitat should be located in such a way that neighbors share the responsibility for maintaining them, and are also able to sustainably consume their productive services.

There are a handful of examples of residential developments that have embraced these sustainable design values in order to reduce their ecological impacts. The following case studies highlight some successful residential communities that have used one or more of these sustainability concepts as an influence for its development. These developments have used a series of strategies and influences to regain the connection with nature and its intrinsic values in order to ensure that its residents were 'living lightly' and working towards reducing their ecological footprint.

4.2 **TRYON FARM** LAPORTE COUNTY, INDIANA[6]

Conservation development is a tool used to conserve open space and natural communities in rural and suburban areas through selective, carefully planned development—essentially, preservation by development. Though the usefulness of this tool has been debated, the basic idea behind conservation development is that proactive individuals with a deep concern for the land are able to protect large areas of precious resources or natural land systems. Conservation development generally includes a developer purchasing a large swath of land and selectively developing particular areas of it, while leaving the remaining spaces untouched in order to ensure that impact from human inhabitation is mitigated. "Development usually clashes with preserving green space, but [places like] Tryon Farm has shown land can be set aside, not by government requirement, but because people want it."[7]

Tryon Farm is a 170-acre site in LaPorte County, Indiana, sixty miles from Chicago and approximately one mile from the Indiana Dunes National Lakeshore on Lake Michigan. (Figure 4.5) The site was formerly the location of a cattle farm and includes many distinct natural features. The dunes region of Northwest Indiana boasts incredibly diverse natural communities including old growth forests, wetlands and swamps, and prairies that compliment the ever-changing sand dunes. The site of Tryon Farm is no exception. The development was designed and constructed to take into consideration the ecological and cultural history of the land, and to minimize development impacts during both the construction and habitation phases. (Figure 4.4)

Planners, designers and builders of Tryon Farm had a series of guidelines in mind when developing the land and the residential structures that would be a part of the community. First and foremost, the guidelines created development criteria that would preserve the existing farmland and woods that existed on site. Additionally, these guidelines aimed to reestablish former prairies that were native to the area, as well as to build upon the wetland areas and establish a safe native wildlife habitat. Tryon Farm would utilize natural systems for processing household wastewater, controlling storm water and irrigation, and managing other types of on-site waste. Finally, the amount of roads and impervious surfaces constructed would be kept to a minimum, allowing 120 acres—nearly three-fourths—of the overall site to be retained as natural open space.

The fifty-eight homes on site were developed to fit the context of their natural communities, or settlements, and like the development itself responded to guidelines for design and construction. All homes, regardless of their ecological setting on the site, were to be clustered together with their neighboring units in an effort to reduce the amount of developed land and infrastructure needs. They were also to be of a simple design in order to reflect and respect their natural environments, made from sustainable materials and built with quality construction methods. Each residential structure was designed to respect individual privacy, utilize the potential of natural resources such as sun and wind and keep night lighting to a minimum to mitigate wildlife disturbance. (Figure 4.6)

There are several distinct natural communities that have influenced settlement areas for clusters of housing on the site. These include the Farmstead, Wood, Pond and Dunes settlements. The Farmstead is the location of the original barn and dairy buildings,

and is bordered by the ponds and prairies that exist on the site. The Woods settlement contains residential structures that are of a minimalist design and are secluded in an area of mature forest. The Pond settlement contains residential structures clustered around shared courtyards and homes that are designed to maximize energy efficiency. Each of these settlements are connected to modern utilities—gas, electric, cable and municipal water—all of which are buried. The development clusters also connect to wetlands that clean household waste and divert it for farming needs.

Developers worked to conserve land for its intrinsic values—so as not to disturb the natural system services and processes that are crucial for human life. This included the location of ponds and constructed wetlands in areas that were naturally low-lying in order to utilize the site's natural topography for drainage. A thorough understanding of the site's history also showed developers areas where cattle had formed walking paths. These became the paths for the new roads that would traverse the site. Designers also wanted to preserve natural resources for its aesthetic and sociocultural values. Individuals that reside in Tryon Farm care about the preservation of open space and the wise use of resources. Because open space is well managed and cared for, these areas are available to be used for more than just their natural system services, but also for learning, psychological health and recreational such as hiking and bird watching. Additionally, because the heritage of the site as a farm has been preserved, individuals can engage in farming and gardening, much like the site's original inhabitants would have.

The site's managers and residents attempt to utilize as many of the natural systems as possible within the neighborhood for on-site needs. There are goats and chickens that reside in the farmstead and provide milk and eggs for residents.

Neighborhood managers collect wood from fallen trees to be used for firewood. Many neighborhood residents engage in projects that include maintaining the neighborhood's vegetable garden, sponsoring workshops on conservation and planning issues, and constructing wildlife habitats in conjunction with the Tryon Farm Institute.

The sprawl of urban areas into green-field and rural areas is somewhat inevitable. However, Tryon Farms is a model for how exurban development can respect the history and ecology of a particular place, and make its residents aware of the opportunities and limitations of the land and design within these constraints. "Thankfully, developments like Tryon Farm are proving that all new housing doesn't have to be in cookie cutter subdivisions."[8]

4.3 **VILLAGE HOMES** DAVIS, CALIFORNIA[9]

Village Homes was constructed in the western part of Davis, California, a suburb of Sacramento, beginning in 1975. The inspiration for Village Homes was a reaction to the conventional housing types and models of sprawl that were commonplace in the 1970s; suburbs in which land and natural resources were not given adequate consideration. The vision for this new suburb was to encourage a sense of community by designing a neighborhood that was focused on the conservation of energy and natural resources while retaining an aesthetically pleasing design through its landscape. The design of the neighborhood combines strategies for passive solar design, shared open spaces, natural drainage systems and edible landscaping.

Village Homes is designed to make the most of the solar potential that is abundant in central California. The subdivision includes 225 single-family homes and twenty apartment units. All residential units are arranged along streets that are oriented in an east-west direction in order to utilize passive solar design. (Figure 4.7) While some units have active solar infrastructure including solar panels, most homes are designed with large, south-facing windows to make use of winter sunlight for heating and day lighting. West-facing windows are kept to a minimum to reduce energy needed for cooling homes during the summer as a result of direct sunlight. (Figure 4.9) Between fifty and seventy-five percent of the household heating comes from the combination of active and passive solar systems.[10] Additionally, a frequently-used community center and neighborhood swimming pool feature solar heating.

Within the neighborhood, roads are narrow, in most cases less than twenty-five feet wide with no on-street parking, in order to reduce the amount of pavement that is exposed to summer sun contributing to the heat island effect. Air temperature above the streets in Village Homes is approximately ten to fifteen degrees cooler than streets elsewhere in Davis, California as a result of the reduced paving and a mature tree canopy.[11] What began as a strategy for reducing heat and storm water run-off yielded other unexpected environmental benefits. Because the emphasis was removed from the vehicle and placed on the pedestrian, fossil fuel consumption and pollution as a result of driving was reduced. Additionally, because roads and development were limited to particular areas, large swaths of land were conserved in order for natural processes to occur.

Forty percent of the total acreage in Village Homes is dedicated to various types of open space. These open spaces were designed to mitigate human impacts on many of the intrinsic, sociocultural and aesthetic values of nature. Open spaces are scattered throughout the neighborhood that provides habitat for native wildlife, enjoyable views for residents, recreational space, food productivity and profit, and the appropriate function of natural processes and systems. Two large green belts accommodate for twenty-five percent of this open space. These greenbelts are areas with formal landscaping that can be used as park spaces and also feature an extensive system of pedestrian and bike paths. (Figure 4.8) Houses face common areas rather than the vehicular streets. Typically, eight houses are organized into clusters with shared household common spaces that are planned and cared for by the homeowners. These commons feature a variety of landscape features, gardens and play structures. Finally, two gardens on the west side of the neighborhood are maintained as individual plots for growing food, and orchards and vineyards run throughout the entire neighborhood.

At the time of its development, the plan for the neighborhood included an innovative natural drainage system that ran throughout the entire subdivision. This system combined a series of creek beds, bioswales and retention ponds that served to divert water away from storm drainage. This system is able to adequately accommodate normal periods of rain as the result of the decreased amount of paved surfaces and significant acreage retained as open and natural areas. This drainage system helps to retain moisture in the soil that supports the vineyards, productive crops and other vegetation that are scattered throughout the neighborhood. These features also

significantly reduce the amount of water that is needed to maintain the landscaping. Clustering landscape features, retaining moisture in soil and redirecting storm water allows Village Homes to use just two-thirds of the quantity of water of similar subdivisions in the area.[12]

Much of the open spaces and productive vegetation in the neighborhood are both cared for by and available for the consumption of Village Homes' residents. Residents are responsible for caring for their household commons, which are shared with their immediate neighbors. Individuals maintain their own garden plots, and maintenance crews care for crops and neighborhood-wide vegetation. Work parties are planned regularly, which include residents of the neighborhood volunteering their time for maintenance projects and other activities such as harvesting fruit from trees. This helps the neighborhood's association save money on hired workers. In exchange, residents are allowed to consume the products of the landscaping at any time, given that they are careful to only harvest a quantity appropriate for themselves and their families. Due to this careful maintenance and shared system of work, there are nearly 30 varieties of fruit and nuts available, with something fresh nearly every month of the year. Excess produce, primarily the yield from the almond orchard, is sold to processors for a profit which is returned to the neighborhood. This generates nearly $3,000 each year that is dedicated to the neighborhood's maintenance fund.[13]

Village Homes is a residential community that was careful to consider the productive capacity of the land—both in terms of crop productivity and passive energy use—and to design the human settlement around these functions. The design also

addressed short- and long-term threats to natural system function and created a strategy that was not only ecologically and economically sound, but also aesthetically pleasing.

4.4 **PRINGLE CREEK** SALEM, OREGON[14]

Pringle Creek is a sustainable suburban development approximately three miles from downtown Salem, Oregon. Three main development principles and a range of sustainability goals make it an ecologically healthy and socially vibrant neighborhood. These guiding principles include a commitment to the highest standards for green building, energy efficiency and respect for the functions of the natural environment. The neighborhood includes 139 residential lots with a diverse mix of housing types including traditional single-family housing as well as attached homes, row houses, live-work lofts and a cluster of single-family net-zero homes. The walkable neighborhood also features a mixed-use village center with locally-owned businesses and community buildings. Roughly thirty percent of the neighborhood's thirty-two acres have been preserved as open space for natural features and recreation. (Figure 4.10)

The first two guiding principles of Pringle Creek are its commitment to green building and energy efficiency. The subdivision utilizes an existing site, focusing on redevelopment rather than building on a green-field site. Several existing buildings on the site of the new subdivision have been preserved and renovated in accordance with LEED Silver standards. New community buildings are built to achieve LEED Platinum standards. Plans for new residential units must demonstrate an adherence to the

neighborhood's developed standards for efficiency and green building before plans can be approved. These requirements for individual housing units meet and exceed the Earth Advantage and Energy Star standards. Standards include elements such as energy efficient appliances, windows and building materials, residential unit design that maximizes passive solar and day-lighting potential, and construction from lumber that is certified by the Forest Stewardship Council. During the construction phase of the development, care was given to reduce waste and engage in green building techniques. Additionally, all construction and other heavy equipment on site run on bio-diesel fuel.

One cluster of homes within the development features twenty-six net-zero single-family units. (Figure 4.11) These homes include systems that neutralize the carbon emissions that result from household electrical generation, and strive for a zero-footprint impact on environmental factors such as energy generation and greenhouse gas emissions. The village center and the adjacent mixed-use buildings have the potential to utilize geothermal heating and cooling. Geothermal systems utilize the consistent underground temperature to regulate the interior temperature of the buildings and structures under which the system is located. The combination of these goals and strategies for Pringle Creek's green building and energy efficiency earned it the Green Land Development of the Year award by the National Association of Home Builders.

Consideration for the natural environment is the third guiding principle for development of Pringle Creek. Twelve acres have been preserved for various types of open spaces. These include rehabilitated creeks and wetlands, restored natural wildlife habitats and spaces for parks, trails and community gardening. During the construction

of the various residential clusters within the subdivision, eighty percent of the existing mature trees were preserved. Housing is arranged in order to respond to the natural communities that exist on the site of the development, including areas of high slopes and prairies.

Principles of conservation and strategies for reuse of materials allow Pringle Creek to reduce the impact of humans on the natural environment. The neighborhood's zero-impact storm water system includes a series of green streets. (Figures 4.12 & 4.13) These streets which feature permeable paving and no curbs, infiltration verges and bioswales, rainwater harvesting systems and landscaping designed to efficiently guide water back to the creek. The design for green streets allows for ninety percent of the storm water run-off to return to the soil and recharge the aquifer. Harvested rainwater is used for on-site, non-potable water needs such as in the community gardens and landscaped green spaces.

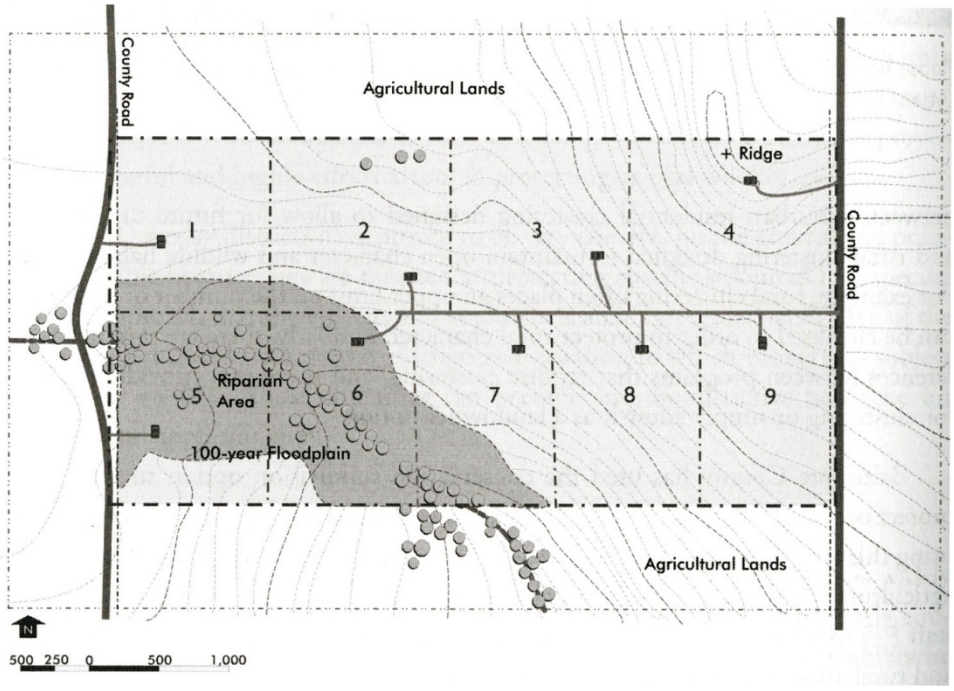
Other strategies for sustainability include the community gardens, on-site use of recycled materials and co-op and learning opportunities. The neighborhood's community garden plots can be used for growing food or flowers and utilizes composting and organic gardening. Extra food that is produced in the gardens can be donated to the nearby Marion-Polk Food Share. Construction of the development included the recycling of nearly 200 tons of concrete and 100 tons of wood and steel—an amount which is continually growing. Fallen timber, or that from trees that must be removed, is used for construction projects throughout the site. The Sustainable Living Center utilizes the neighborhood as a living laboratory to teach individuals about reducing their ecological

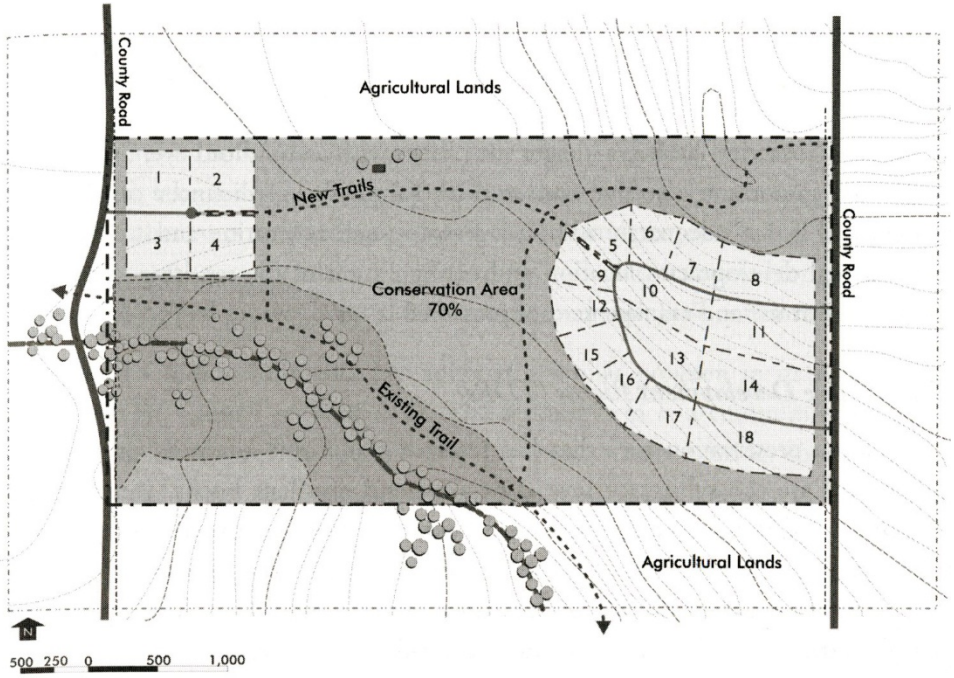
footprint and understanding the intricate ecological, economic and social connections of places. Pringle Creek's Sustainable Living Center also hosts or sponsors such events as Urban Farmer Certification classes and the Salem Green + Solar Fair.

The neighborhood participates in the Flower Power Bio-diesel cooperative, which is dedicated to providing a source of clean fuel for individuals to utilize for their driving needs. The neighborhood also addresses transportation concerns through the community car share program, the bike share and repair program, and its corridor of sidewalks, bike paths and trails. Future plans for mass transit will provide Pringle Creek residents with easy commuting options to downtown and other regional destinations.

Pringle Creek is an example of a suburban residential community that mitigates the natural system disruptions of development and suburban lifestyles. By engaging in building practices that minimize the use of raw materials, imported products and the creation of waste, neighborhoods such as Pringle Creek, individuals units and the entire neighborhood can significantly reduce their ecological footprint and negative environmental impacts. Additionally, increasing energy efficiency and reducing emissions allows these human settlements to be more ecologically sound.

Figure 4.1: Achieving residential sustainability will require a combination of top-down and bottom-up approaches by all involved in the planning, design, construction and inhabitation of residential communities. *Source: Graphic produced by author.*





Figures 4.2 (top) and 4.3 (bottom) illustrate how the same 320-acre parcel of land can be subdivided. Figure 4.2 shows the site divided into nine lots without consideration for the trees, creek, floodplain and ridge that are existing on the site. Figure 4.3 demonstrates that smaller, clustered lots not only preserves the natural areas but also generates the opportunity for eighteen lots. *Source: Deurksen & Snyder. Creating Nature Friendly Communities: Habitat Protection and Land Use Planning.* p 72-73

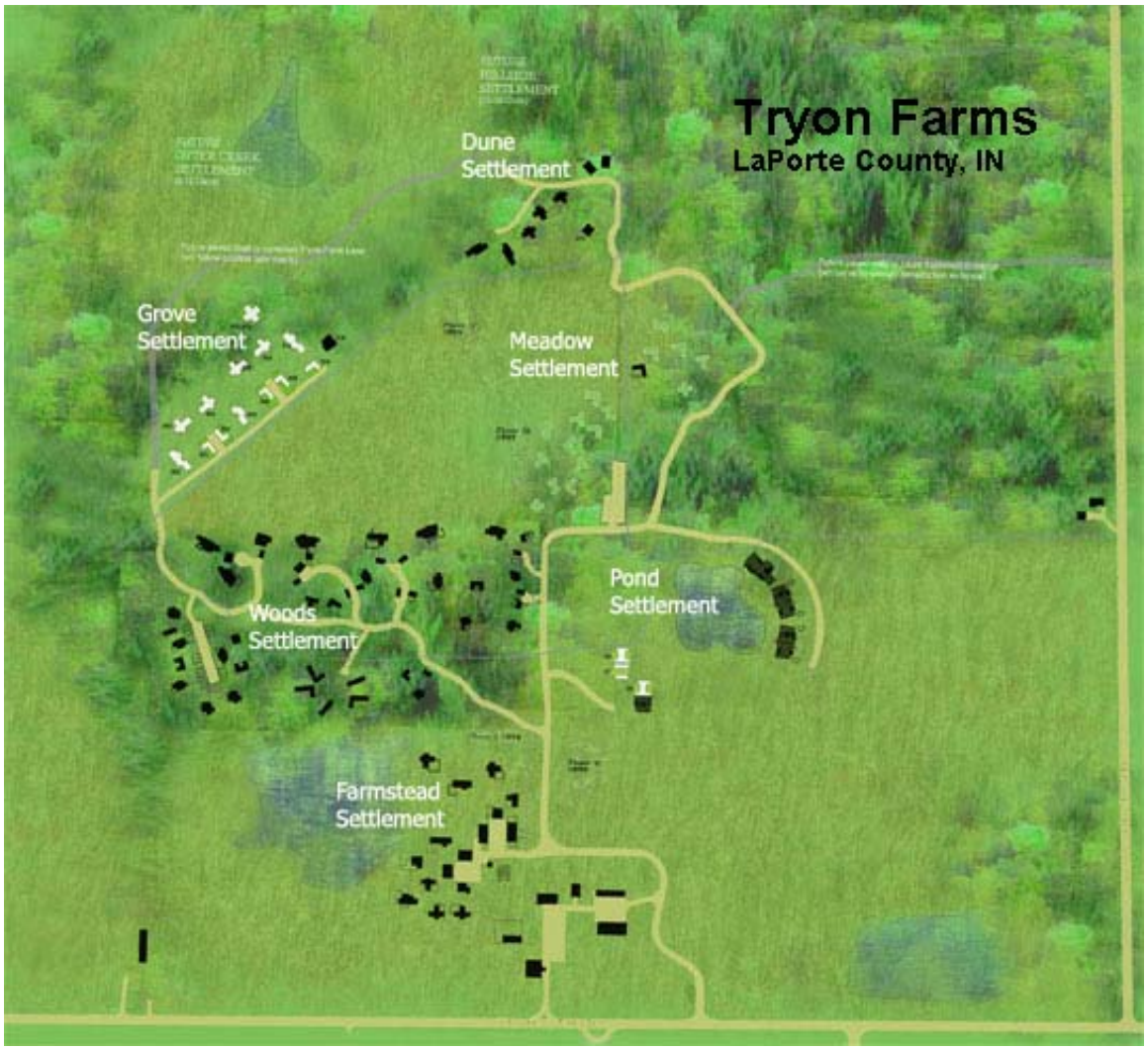


Figure 4.4: Site Plan for Tryon Farms in LaPorte County, IN shows the relationship of the various settlements in the development to the natural communities that they are a part of. *Source: Tryon Farm's website <http://www.tryonfarm.com/settlements.html>*

Figure 4.5: (Top) Aerial view of Tryon Farm in LaPorte County, IN showing its proximity to the shoreline of Lake Michigan and the natural features that influence its clustered settlements. *Source: Tryon Farm's website <http://www.tryonfarm.com/settlements.html>*

Figure 4.6: (Left) Photos of the various architectural types for each of the settlements. *Source: Tryon Farm's website <http://www.tryonfarm.com/settlements.html>*

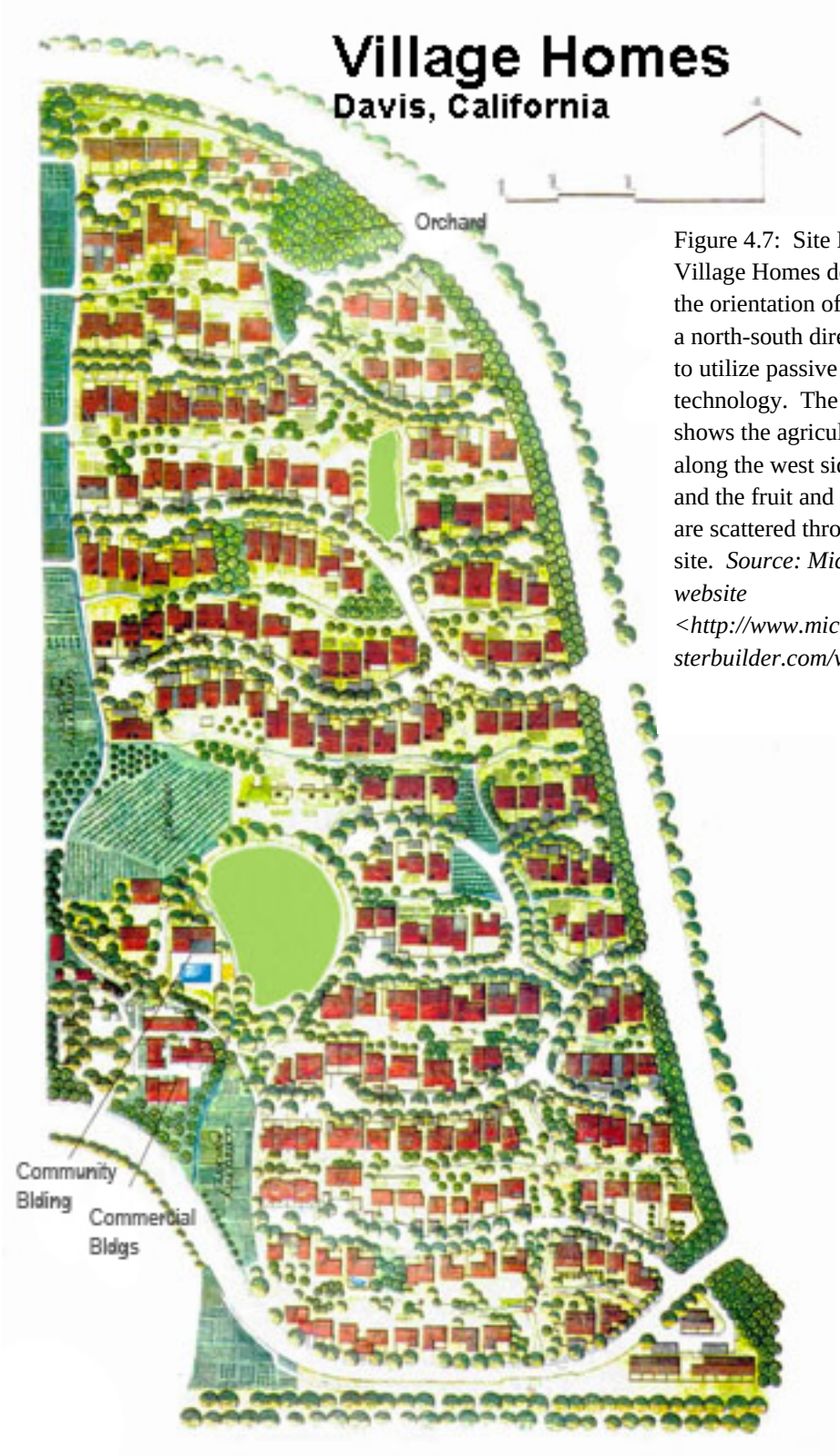


Figure 4.7: Site Plan for Village Homes demonstrates the orientation of the homes in a north-south direction in order to utilize passive solar technology. The site plan also shows the agricultural lands along the west side, the orchard and the fruit and nut trees that are scattered throughout the site. *Source: Michael Corbett website <http://www.michaelcorbettmasterbuilder.com/village.html>*

Figure 4.8: Aerial image of Village Homes shows that pedestrian and bike paths as well as shared household common spaces create a shared environment between the homes that is conducive to recreation and socialization. Houses are oriented away from the vehicular streets. Source: *Browning and Hamilton. Village Homes: A Model Solar Community Proves Its Worth. Designing a Sustainable Future. Issue 35,* <*http://www.context.org/ICLIB/IC35/Browning.htm*>

Figure 4.9: Image shows the character of homes in Village Homes. The homes include large south-facing windows for passive solar, and some homes feature solar panels. Natural landscaping acts as an innovative drainage system that mitigates the impact on storm water systems in the area. Source: *Browning and Hamilton. Village Homes: A Model Solar Community Proves Its Worth. Designing a Sustainable Future. Issue 35,* <*http://www.context.org/ICLIB/IC35/Browning.htm*>

Figure 4.10: Site Plan of Pringle Creek illustrates the development of the neighborhood units around the creek and its riparian zone, as well as the existing mature trees. *Source: Pringle Creek Community website. <http://www.pringlecreek.com/overview/housing.htm>*

Figure 4.11: (Top) A net-zero home in Pringle Creek that is built in a traditional 21st century suburban character. Figure 4.12: (Botton) Shows Pringle Creek's innovate green street system that includes permeable paving, gravel shoulders, planted bump-outs at corners and much landscaping to help with drainage. *Source: Pringle Creek Community website. <http://www.pringlecreek.com/overview/housing.htm>*

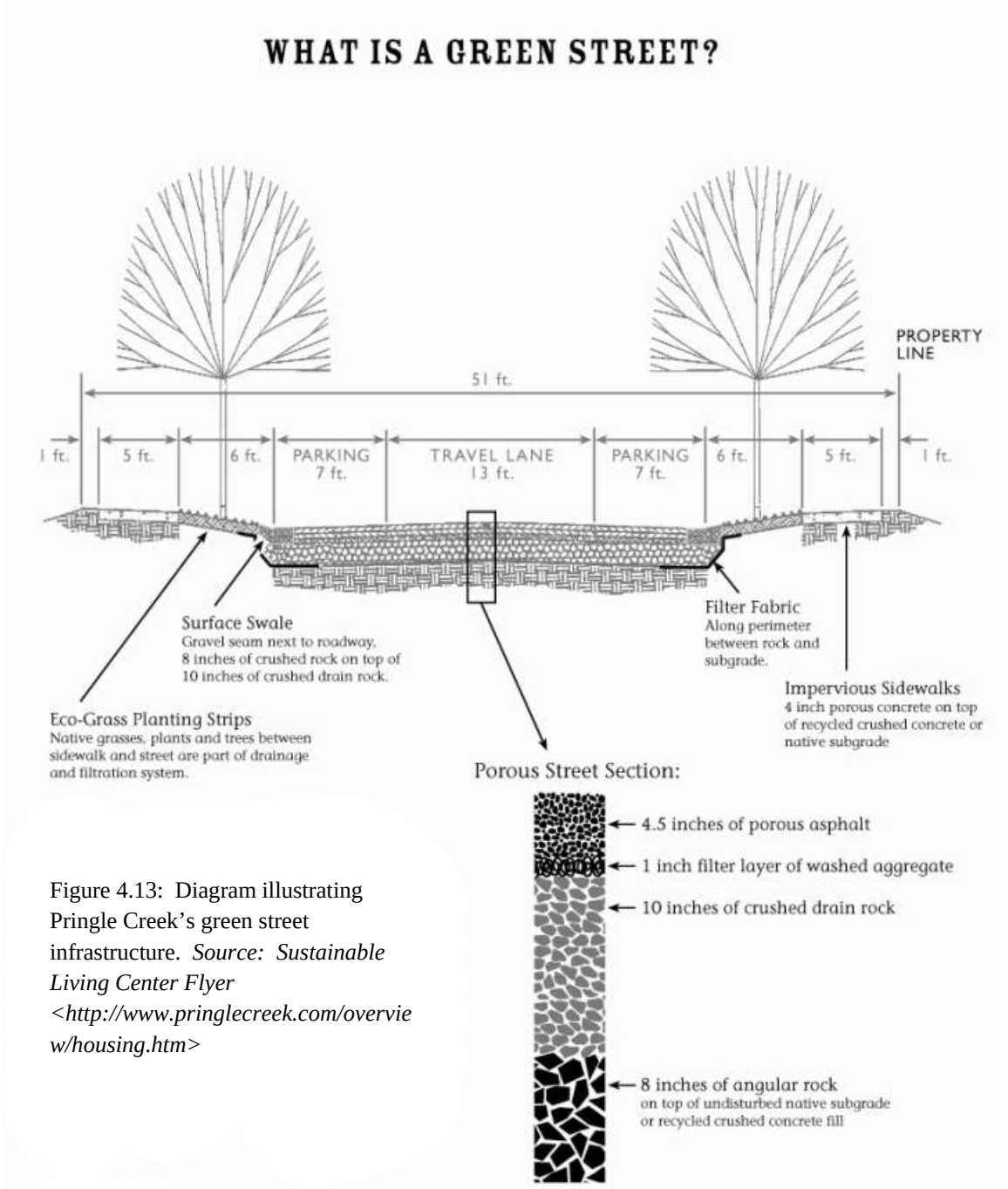


Figure 4.13: Diagram illustrating Pringle Creek's green street infrastructure. *Source: Sustainable Living Center Flyer <http://www.pringlecreek.com/overview/housing.htm>*

CHAPTER FIVE **SUBURBIA TRANSFORMED 2.0: COMPETITION ENTRY**

"The human race is challenged

more than ever before to demonstrate our mastery—

not over nature but of ourselves. –Rachel Carson, 1962"[1]

5.1 COMPETITION REQUIREMENTS[2]

The research and case studies presented in Chapters Two through Four were compiled in order to influence a design competition entry. The competition, "Suburbia Transformed 2.0: Exploring the Aesthetics of Landscape Experience in the Age of Sustainability," is hosted by the James Rose Center for Landscape Architectural Research and Design. The James Rose Center was started in honor of James Rose. After graduating from Harvard University and entering the 'real' world of landscape architecture, Rose lost faith in the values and abilities of modern planning and design professionals. By the mid-1950's he had retreated from the public practice of landscape architecture and went on to work on private design. His design focused on gardens that contrasted the "environmental excess and cultural banality of emerging post-WWII suburbs."[3] His designs incorporated objects that he found around the sites, recycled objects from around the local area, and native plantings. They were organized in ways that were more environmentally sustainable, economical and reduced the amount of resources that were wasted in their construction and maintenance.

The "Suburbia Transformed 2.0" competition is looking for design solutions to the small, detached single-family residential lots that are typical of the modern suburban fabric. Sites must be zoned for single-family residential use and be less than two-acres. In this design competition, both built and visionary (unbuilt) works are accepted. The goal of this international residential design competition is to bring both students and practitioners together to promote and celebrate models for residential design that go beyond green. These designs should demonstrate how sustainable strategies, tactics and

technologies can enrich the aesthetic experience of the suburbs. The designs should focus on making the most of existing materials available on-site and utilize local, low-energy-consuming, and non-polluting materials when available. The designs should also consider the site's relationship to the larger environmental systems and consider the means of future growth and evolution of these gardens. Final deliverables for the competition entries are due in March of 2012 and include a written, 250-word description of the site's response to the competition goals, plans illustrating both the site's existing conditions and the final design, and technical images and illustrations that demonstrate the design's aesthetic value.

5.2 CREATIVE PROJECT OVERVIEW

The competition entry for this creative project focused on the transformation of a single-family residential lot in a Muncie, Indiana suburb. The development was constructed primarily in the early 2000's and is located on the northwest fringe of Muncie's urbanized area. (Figure 5.1) It was built on a lot with the approximate dimensions of 130'x250', nearly three-quarters of an acre, and is listed as having a flat terrain. (Figure 5.3) According to property information acquired from the Delaware County online Geographic Information System and Property Data, the two-story, 2,837 sq.ft., four bedroom home was constructed in 2000, and sold to its current property owner in 2009.[4]

A basic inventory of the site's features includes the two-story home which includes a concrete driveway and a wooden deck in the rear yard. A fence surrounds the large back yard, which includes a row of trees along the rear fence line and a few scattered evergreen trees throughout the yard. No detached accessory structures exist on the property, nor do any natural features, including small waterways or flood plains, transect the site. An analysis of a one-half mile radius from the site—which is considered to be a ten minute walking distance—indicates that the context of the site includes many smaller lot suburban homes and undeveloped farmland and green-field areas. There is also a series of creeks and drainage ditches within this half-mile distance from the site. (Figures 5.2 & 5.6)

The designs for retrofitting this site are presented in section 5.4 and seek to address the following issues for residential sustainability: addressing storm water runoff by considering natural topography of the site, increasing native vegetation in order to provide wildlife habitat for insect and bird species, incorporating edible landscaping in appropriate areas on site and utilization of passive solar potential. (Figure 5.11)

5.3 EXISTING SITE CONDITIONS

Figure 5.1: Site is located on the northwest fringe of the urbanized area of Muncie, IN. *Source: Google Earth with author's annotations.*

Figure 5.2: A ten-minute walk from the site (one-half mile) includes only other similar suburban homes and undeveloped green-field and agricultural sites. No daily amenities can be accessed from the site without the use of a personal vehicle. *Source: Google Earth with author's annotations.*

Figure 5.3: Site (indicated by dashed lines) dimensions are approximately 250'x130' and the site's approximate size is three-quarters of an acre. The site is surrounded by several residential properties that are much larger (neighboring site is nearly twice the size). *Source: Delaware County GIS hosted by Beacon*. < http://beacon.schneidercorp.com/?Site=DelawareCountyIN>

Figure 5.4: Site and adjacent properties are zoned for single-family residential development. *Source: Delaware County GIS hosted by Beacon*. < http://beacon.schneidercorp.com/?Site=DelawareCountyIN>

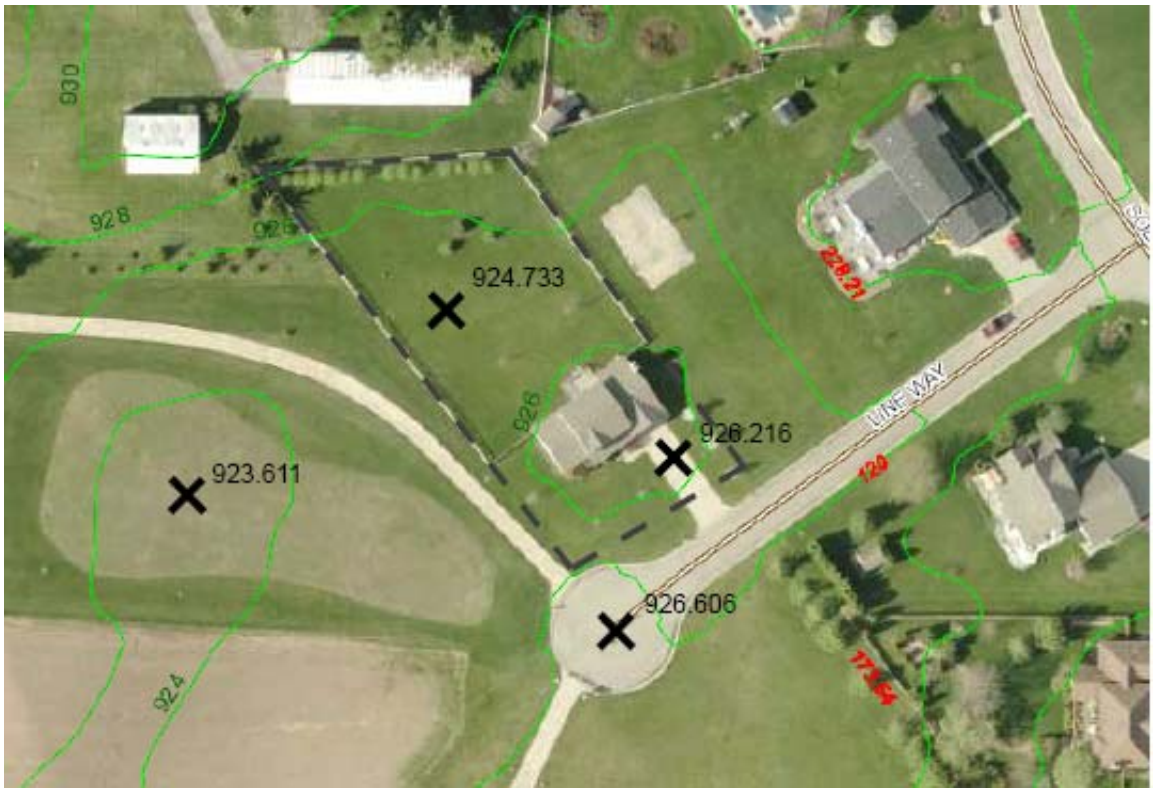


Figure 5.5: Property search data lists the site as "flat." Topography lines and spot elevation measurements indicate that there is a very slight dip in the property near the center of the rear yard (near spot elevation 924.733) and sloping towards the southwest through an adjacent property. *Source: Delaware County GIS hosted by Beacon.* < http://beacon.schneidercorp.com/?Site=DelawareCountyIN>

Figure 5.6: There are no water features on, or immediately adjacent to, the site. However, Figure 5.5 indicates that drainage may slope towards the southwest where a series of small creeks and drainage ditches exist. *Source: Delaware County GIS hosted by Beacon*. <http://beacon.schneidercorp.com/?Site=DelawareCountyIN>

Figures 5.7 (top) & 5.8 (bottom): Vegetation in the front yard of the site is sparse. Three young trees line the eastern edge of the drive, and two are placed arbitrarily in the front lawn. *Source: Figure 5.7, photograph by Author; Figure 5.8, Google Earth Street View.*

Figure 5.9: View of rear yard of site. A row of young deciduous trees border the northern fence line and several young coniferous trees are clustered in the center of the yard. *Source: Photograph taken by Author.*

Figure 5.10: View of rear yard immediately adjacent to the house; features a wooden deck and landscaping which includes low-lying shrubs. *Source: Photograph taken by Author.*

5.4 COMPETITION SUBMISSION

Figure 5.11: Analysis of existing site conditions provides an understanding of which issues of residential sustainability should be addressed: water runoff, increased vegetation for wildlife habitat and edible landscaping, and day lighting. *Source: Illustration by Author*.

Figure 5.12: Conceptual site plan suggests solutions for the residential sustainability concerns addressed in Figure 5.11. *Source: Illustration by Author.*

Figure 5.13: Proposed plan for site utilizes native plant species and productive landscaping to address the site's sustainability issues. The plan calls for a wildlife area, contemplative area, a water feature, gardens and fruit trees, modified landscaping to utilize passive solar potential, and rain gardens for storm water management. *Source: Illustration by Author.*

Figures 5.14(above) and 5.15(below): Native plant species that can be used on the site to attract native birds and insects. *Source: "Landscaping with Native Plant Species" Indiana Native Plant and Wildlife Society.*
<http://www.naturalheritageofindiana.org/participate/INPAWS2.pdf>

Figure 5.16: Water captured in rain barrels can be used for watering landscaping and gardens. Excess water can be diverted to the water feature via a buried hose. *Source: Illustration by Author.*

Figure 5.17: Rain barrels can be purchased or constructed such that rain gutters drain into collection units. Hoses can be attached to allow water to slowly percolate through 'soaker hoses' into a landscaped area, or with valves to water far-off landscapes as pictured in this image. *Source: "Everybody is Going Green." <http://beachbrights.blogspot.com/2010/01/everybody-is-going-green.html>*

Figure 5.18: Rendering illustrates the use of vertical gardens for on-site food production as well as insulation from summer sun, modified landscaping that allows windows to utilize day lighting potential and rain barrels for on-site non-potable water needs. *Source: Illustration by Author*.

Figure 5.19: Sketch of an herb garden planted in Ball Canning Jars builds utilizes recycled materials for a unique landscape experience as well connecting an historic and landmark industry in the Muncie community . *Source: Illustration by Author.*

Figure 5.20: Alternative design for vertical garden utilizes recycled gutters attached to the blank wall of the residential structure to plant herbs and small-blooming vegetables. *Source: "How does your garden grow?" Juneau Empire News. <http://juneauempire.com/stories/072508/nei_309624417.shtml>*

Figure 5.21: Curb-side rain gardens to help prevent excess runoff reaching the storm sewers and providing natural filtration for contaminations in storm water. *Source: "Greenversations" United States Environmental Protection Agency. <http://blog.epa.gov/healthywaters/tag/rain-garden/>*

CHAPTER SIX **REFLECTION & SUMMARY**

"Aesthetic and symbolic values of nature can also be

deliberate design objectives in the built environment.

One of the glaring deficiencies of the contemporary city and much sustainable design,

is the relative absence of inspiring aesthetic and symbolic celebrations

of the natural world. Yet, we can capture inspiring aesthetic and symbolic

expressions of the natural world in the built environment by

more creative and imaginative design.

The result could be not only enhanced morale

but also greater inventiveness, stimulation and productivity."[1]

6.1 SUMMARY OF SITE DESIGN

The proposed site design for retrofitting a suburban lot in Muncie, Indiana addresses many of the ecological issues discussed throughout this creative project. In particular, it provides remediation for impacts that suburban development has on local, natural resources, native species of plants and wildlife, and water and air quality. Additionally, the design provides opportunity for the site's inhabitants to engage in many of nature's values. The site plan has been designed to work in unison with nature's inherent regulating, provisioning and supporting services, as well as provide an appealing setting for the site's occupants to enjoy its aesthetic value. (Figure 5.13)

The proposed plan includes the use of native vegetation throughout the site to reduce the resource and water quality impacts of the property. Because native species require much less maintenance, water will be conserved and dangerous chemical fertilizers will not need to be used on site. Additionally, clustering these plants into a no-mow area that covers a significant portion of the site will help to reduce the amount of non-native turf grass that is left in the yard. These native plants also serve to attract native wildlife and provide a habitat that is abundant with the food and shelter services needed by these species. Insects, birds and butterflies will be attracted to these plants and be an instrumental supporting service to help pollinate and maintain the newly-installed vegetation. (Figures 5.14 & 5.15)

The design includes a contemplative area that is nestled within a cluster of trees, shrubs and other vegetation in order to provide a solitary area on the site for reflection and the enjoyment of nature. This area will encourage those who enjoy it to appreciate nature for its most intrinsic values and provide will offer psychological and emotional

health benefits. The surface of the seating area will be made from pulverized concrete that has been salvaged from any number of Muncie's former industrial sites that now lay vacant. Additionally, the outdoor furniture that is placed in this contemplative area can be constructed from recycled metals, such as steel.

Utilizing reclaimed materials achieves three sustainability goals. First, pulverized concrete is a permeable alternative to a paved surface, and will not significantly increase water runoff issues on the site. Because these materials are recycled, waste products that would normally be deposited in a local landfill are recaptured and repurposed to extend their lifecycle. Finally, these products are a crucial part of Muncie's history. Muncie was formed as an Industrial town with some of its first major companies manufacturing items such as steel wire and products, and glass canning jars. Many of the sites of these industrial operations still exist, though they are underutilized. Using these materials for the decorative needs of the site's design reflects a connection with and understanding of the local area. This indentifies the site with a unique area rather than a rubber stamp appearance in a residential community that could be in any city in the United States.

The productive food area of the site provides many benefits. First and most notably, it provides a range of fresh, organic fruits, vegetables and herbs that can be consumed by the site's occupants and neighbors. The vegetable garden located along the back side of the home can accommodate any range of vegetables such as beans, peppers, lettuce, carrots, pumpkin and squash. The porch can be lined with the aforementioned glass canning jars which would act as planters for small plants, herbs or flowers. (Figure 5. 19) The vertical garden along the southwest side of the home can accommodate crops that are tall and require stakes such as corn, tomatoes and blueberries and vine crops such

as strawberries. This large, blank wall could also be fixed with recycled gutters that are repurposed to act as planters for small-blooming crops and an herb garden. (Figures 5.18 & 5.20) Covering this surface with vegetation will not only increase the site's ability to produce food, but also acts as an insulator. This wall is exposed to direct sunlight for much of the afternoon and evening hours during the summer, which affects interior temperatures of the house, increasing the need for energy use for cooling. The vegetation will turn the wasted potential energy from the sun into a productive natural resource by helping plants to grow, and will provide a buffer to reduce the impact of the sunlight on interior temperatures. Finally, the design calls for several fruit trees to be clustered near the southwest corner of the house to provide fruit, as well as shade for the vegetable garden to avoid being exposed to summer sunlight throughout the entire day.

The proposed site plan calls for the landscaping beds on the front side of the home to be modified for two purposes: to incorporate rain barrels and to utilize the passive solar potential of the site. Placing rain barrels at the base of the gutters, which are located at five points around the exterior of the home, allows storm water to be captured and stored for non-potable water needs on the site. Rainwater can be harvested to be used on the site's landscape and gardens, for cleaning, or could even be filtered into the house for non-potable needs, such as in toilets. This site's design calls for four barrels to be placed around the home. The barrels on the south and southwest sides of the site will be fitted with soaker hoses, which will allow rain water to slowly percolate out of the buckets and through the landscaped areas of the site. Excess rainwater from these barrels will flow through buried hoses and will be released in the water feature in the rear yard. (Figures 5.16 & 5.17) This will allow for an aesthetically-pleasing water feature to be maintained

on the site without the wasteful use of clean, potable water. Additionally, it will allow much of the rain water that would otherwise have been diverted into a storm sewer to return to the soil and the natural hydrologic cycle.

The shrubs and other landscaping materials that existed on the site covered the large, south-facing windows of the home. The design for this landscape has been modified so that the front windows have been uncovered and exposed to the southern sun for day lighting and heat in the winter. The former shrubs can be replaced with tall, grass-like shrubs that flank the windows and garage door, and an abundance of low-lying shrubs and flowers for an attractive landscape composition. Due to winter sun patterns, these windows are located in an ideal location to utilize the sun for lighting during the daytime, which could reduce the need for electricity to run lights in the common, social areas that are situated towards the front of the home.

Finally, the site's design calls for two small rain gardens to be installed on either side of the driveway, near the site's access road. (Figure 5.21) These gardens will not only provide an attractive landscape at the site's first point of arrival, but also help to filter water runoff from the site before reaching the storm sewers. These gardens can feature attractive, water-tolerant plants and shrubs which can help return water runoff from the driveway back into the soil and the hydrologic cycle.

6.2 CONCLUSION

This creative project has demonstrated the negative ecological impacts inherent in the design, construction and occupation of modern suburban developments. While there

are a range of influences shaping this pattern of development, it is important for those designing, building and living in these communities to recognize that the impacts of this development are both widespread and long-lasting. Creating a new model for ecologically friendly and sustainable suburban design must be a priority for individuals involved with the development of future residential communities in the United States. Chapters Five and Six have demonstrated the ease with which suburban sites can be retrofitted to mitigate many of the ecological impacts of this type of residential settlement. However, new sites must be constructed in such a way that critically considers these issues, and utilizes them as an influence in order to shape human settlements.

Retrofitting the existing residential model, and creating a prototype for new development is an important starting point for achieving ecological sustainability in the United States. However, it is important that this vision not become so narrow that it excludes other critical approaches to sustainability. Retrofitting the suburbs alone will not achieve an ecological, economic or sustainable residential community. Behaviors, beliefs and business models must also be an important part of this retrofit of the American lifestyle. The triad of influences and entities that must work together in order to achieve true sustainability must not be forgotten, and much collaboration will be needed to create this new vision for American suburbs.

NOTES

CHAPTER ONE

[1] David Rudlin and Nicholas Falk. *Building the 21st Century Home: The Sustainable Urban Neighbourhood*. (Burlington, MA: Architectural Press 1999) p 84.

[2] The term 'take-make-waste' is a term that has become commonplace when referring to linear, non-sustainable consumption of materials, goods and services. Many authors use the term and the following citation, from the Zero Waste Alliance, is one such example.
Zero Waste Alliance. *"The Case for Zero Waste"*.<http://www.zerowaste.org/case.htm> (September 2011)

[3] David Rudlin and Nicholas Falk. *Building the 21st Century Home.* p 123.

[4] Global Footprint Network. *"World Footprint: Do We Fit on the Planet?"* <http://www.footprintnetwork.org/en/index.php/GFN/> (September 2011)

[5] Chapter Five will contain the design concepts created for the James Rose Center for Landscape Architectural Research and Design. The requirements and submission details for the competition are available in Appendix (A).
James Rose Center for Landscape Architectural Research and Design. *"Suburbia Transformed 2.0."*< http://www.jamesrosecenter.org/competition2/index.html> (September 2011)

CHAPTER TWO

[1] David Rudlin and Nicholas Falk. *Building the 21st Century Home.* p 57.

[2] Jane Jacobs. *The Death and Life of Great American Cities.* (New York, NY: Random House, 1961.)

[3] Constantinos Doxiadis. *Between Dystopia and Utopia.* (Hartford, CT: The Trinity College Press, 1966)

[4] Jared Diamond. *Collapse: How Societies Choose to Fail or Succeed*. (New York, NY: Penguin Group, 2011) p 79-119, 157-177.

[5] David Rudlin and Nicholas Falk. *Building the 21st Century Home.* p85.

[6] Zero Waste Alliance. *"The Case for Zero Waste"*.<http://www.zerowaste.org/case.htm> (September 2011)

[7] Jared Diamond. *Collapse*. p 79-119, 157-177.

[8] James Howard Kunstler, an author and social critic, frequently discusses the impacts of sprawl from the perspective of environmental issues, economics and social considerations. He has described these impacts in his written works, online blog, and various lectures James Kunstler. "Remarks" Hudson, NY, January 2005. <http://www.kunstler.com/spch_hudson.htm> (October 2011)

[9] Timothy Beatley. *Native to Nowhere: Sustaining Home and Community in a Global Age.* (Washington, D.C.: Island Press, 2004) p 3.

[10] Kunstler, James H. "Remarks" Hudson, NY, January 2005. <http://www.kunstler.com/spch_hudson.htm> (October 2011)

[11] David Rudlin and Nicholas Falk. *Building the 21st Century Home.* p 25.

[12] Douglas Farr. *Sustainable Urbanism: Urban Design with Nature.* (Hoboken, NJ: John Wiley & Sons, Inc., 2008) p 48.

[13] Eliza Hall. *Divide and Sprawl, Decline and Fall: A Comparative Critique of Euclidian Zoning.* (University of Pittsburg Law Review Vol.48: 915-952) p 925. <http://lawreview.law.pitt.edu/issues/68/68.4/Hall.pdf>

[14] Lewis Mumford. "The Highway and the City." In *The House We Live In: An Environmental Reader*. (New York, NY: Macmillan Company, 1971) p 72.

[15] Howard Frumkin et. all. *Urban Sprawl and Public Health: Planning, Designing, and Building for Healthy Communities*. (Washington, D.C.: Island Press, 2004) p 38-39.

[16] Ibid. p 1.

[17] John Reps. "Garden Cities of To-Morrow by Ebenezer Howard." Urban Planning 1794-1819, Cornell University. <http://www.library.cornell.edu/Reps/DOCS/homepage.htm>

[18] Keller Easterling. *American Town Plans: A Comparative Time Line.* (New York, NY: Princeton Architectural Press, 1993) p 6.

[19] Thomas Friedman. *Hot, Flat and Crowded 2.0: Why We Need A Green Revolution—And How it Can Renew America.* (New York, NY: Picador, 2009) p 31.

[20] David Kolb. *Sprawling Places.* (Athens, GA: University of Georgia Press, 2008) p 139.

[21] David Kolb. *Sprawling Places.* p 139.

[22] Urban Land Institute. The Practice of Conservation Development: Lessons in Success. 2002.

[24] Howard Frumkin et. all. *Urban Sprawl and Public Health.* p 26-43.

[25] David Rudlin and Nicholas Falk. *Building the 21st Century Home.* p 29.

[26] Timothy Beatley. *Native to Nowhere.* p 11.

[27] Ibid. p 82-83.

CHAPTER THREE

[1] Charles Kilbert. *Reshaping the Built Environment: Ecology, Ethics and Economics.* (Washington, D.C Island Press, 1999) p 155.

[2] Timothy Beatley. *Native to Nowhere.* p 9.

[3] Ciara Raudsepp-Hearne et al. *Untangling the Environmentalist's Paradox: Why Is Human Well being Increasing as Ecosystem Services Degrade?* (BioScience Vol. 60: 8, Sep 2010) p 576-589.

[4] Ibid.

[5] Ibid.

[6] Ibid.

[7] Rachel Carson. *Silent Spring.* (New York, NY: Houghton Mifflin Company, 1962) p 6.

[8] Charles Kilbert. *Reshaping the Built Environment.* p 12.

[9] Timothy Beatley. *Native to Nowhere.* p 12.

[10] Douglas Farr. *Sustainable Urbanism.* p 109.

[11] Dan Chiras and Dave Wann. *Superbia! 31 Ways to Create Sustainable Neighborhoods.* (Gabriola Island, BC, Canada: New Societies Publishers, 2003) p 18.

[12] Volker Radeloff, et al. *Rural and Suburban Sprawl in the Midwest from 1940 to 2000 and Its Relation to Forest Fragmentation.* (Conservation Biology Vol. 19:3, June 2005) p 793-805.

[13] Charles Kilbert. *Reshaping the Built Environment*. p 29.

[14] Douglas Farr. *Sustainable Urbanism*. p 109.

[15] Douglas Tallamy. *Bringing Nature Home: How You Can Sustain Wildlife with Native Plants.* (Portland, OR: Timber Press, 2007) p 32.

[16] Timothy Beatley. *Native to Nowhere*. p 225.

[17] Rachel Carson. *Silent Spring.* p 39.

[18] Ibid. p 7

[19] Ibid. p 188

[20] Indiana Wildlife Federation. "Native Indiana Plants." <http://www.indianawildlife.org/habitatPlants.htm> (September 2011)

[21] The United States Environmental Protection Agency. "Basics of Bird Conservation in the U.S." <http://www.epa.gov/owow/birds/basics.html> (October 2011)

[22] Roger Sanderson. Sunny Side of Life. *McKinney Chamber Magazine* March 2010. p 30-34

[23] Douglas Tallamy. *Bringing Nature Home*. p 31.

[24] Ibid. p 32.

[25] Christopher Duerksen and Cara Snyder. *Nature-Friendly Communities: Habitat Protection and Land Use Planning.* (Washington D.C.: Island Press, 2005) p 4.

[26] Douglas Tallamy. *Bringing Nature Home*. p 36.

[27] Douglas Farr. *Sustainable Urbanism.* p 21.

[28] Carl Elefante. *The Greenest Building Is…One That Is Already Built.* (The National Trust for Historic Preservation. Vol 21: 4. Spring 2007) p 26-38.

[29] William Marsh. *Landscape Planning: Environmental Applications.* (Hoboken, NJ: John Wiley & Sons, Inc., 2005) p 105.

[30] The Story of Stuff Project. *"The Story of Stuff."* < http://www.storyofstuff.com/> (September 2011)

[31] Mindfully.org. "Consumption by the United States." <http://www.mindfully.org/Sustainability/Americans-Consume-24percent.htm> (October 2011)

[32] Mathis Wackernagel and William Rees. *Our Ecological Footprint: Reducing Human Impact on Earth.* (Gabriola Island, BC, Canada: New Societies Publishers, 1996) p 4.

[33] Global Footprint Network. *"World Footprint: Do We Fit on the Planet?"* <http://www.footprintnetwork.org/en/index.php/GFN/> (September 2011)

[34] Mathis Wackernagel and William Rees. *Our Ecological Footprint.* p 29.

[35] Timothy Beatley. *Native to Nowhere*. p 346.

[36] Dan Chiras and Dave Wann. *Superbia!* p 15.

[37] Timothy Beatley. *Native to Nowhere.* p 17.

CHAPTER FOUR

[1] Susan Piedmont-Palladino and Timothy Mennel. *Green Community.* (Washington, DC.: American Planning Association, Chicago, IL and the National Building Museum, 2009) p 54.

[2] Carl Elefante. *The Greenest Building Is…* p 26-38.

[3] Mathis Wackernagel and William Rees. *Our Ecological Footprint.* p 32.

[4] Ibid. p 35-36

[5] Charles Kilbert. *Reshaping the Built Environment.* p 47.

[6] Unless otherwise noted, all information regarding Tryon Farm was gathered from the development's main website.
Tryon Farm Partners, Ltd and Edward Noonan & Associates. "Tryon Farm." <http://www.tryonfarm.com/main.html> (October 2011)

[7] Tryon Farm Partners, Ltd and Edward Noonan & Associates. "Tryon Farm." <http://www.tryonfarm.com/main.html> (October 2011)

[8] Ibid.

[9] Unless otherwise noted, all information regarding Village Homes was gathered from the development's main website.
Village Home Owners Association. "About Village Homes." <http://www.villagehomesdavis.org/> (October 2011)

[10] Bill Browning and Kim Hamilton. *Village Homes: A Model Solar Community Proves Its Worth.* (Designing a Sustainable Future. Issue 35, Spring 1993) <http://www.context.org/ICLIB/IC35/Browning.htm>

[11] Ibid.

[12] Ibid.

[13] Ibid.

[14] Unless othersiwe noted, all information regarding Pringle Creek Community was gathered from the development's main website.

Pringle Creek Community. "Pringle Creek Community Principles." <http://www.pringlecreek.com/principles/principle2.htm> (October 2011)

CHAPTER FIVE

[1] Susan Piedmont-Palladino and Timothy Mennel. *Green Community.* p 152.

[2] Unless otherwise noted, all information regarding the James Rose Center and the design competition was gathered from the Center's main website.

James Rose Center for Landscape Architectural Research and Design. *"Suburbia Transformed 2.0."*< http://www.jamesrosecenter.org/competition2/index.html> (September 2011)

[3] Ibid.

[4] Site information was derived from Delaware County public record for Parcel ID: 0730376030000. All information regarding site conditions are from Delaware County GIS and Property search unless otherwise noted.

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CHAPTER SIX

[1] Charles Kilbert. *Reshaping the Built Environment.* p 50.

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APPENDIX A **COMPETITION CALL FOR ENTRIES**

SUBURBIA TRANSFORMED 2.0: EXPLORING THE AESTHETICS OF LANDSCAPE EXPERIENCE IN THE AGE OF SUSTAINBILITY

AN INTERNATIONAL COMPETITION FOR BUILT AND VISIONARY (UNBUILT) RESIDENTIAL LANDSCAPES

Sponsored by: James Rose Center for Landscape Architectural Research and Design

Co-Sponsored by: American Society of Landscape Architects, New Jersey Chapter; Rutgers, The State University of New Jersey

Background

For most, James Rose is remembered as one of three Harvard students who rebelled against their Beaux Arts training in the 1930s, helping to usher landscape architecture—kicking and screaming—into the modern era. Yet somewhere after Harvard and well into the real world, Rose lost faith in the modern planning and design professions he had helped to inspire. By the mid 1950s he had retreated from public practice and spent most of the latter part of his career designing private gardens that were in direct contrast to the environmental excess and cultural banality of the emerging contemporary post-WWII suburb.

These built critiques were made with found objects, recycled left-over materials, native plants and whatever he could scavenge from the sites themselves. He called them “space-sculptures-with-shelters,” and they reflected the creative, spatial and artistic nature of the garden in ways that were greener, more economical and less wasteful of resources. In doing so, Rose incorporated a conservation ethic into a modern design aesthetic, skillfully choreographing outdoor spatial experiences that inspire us to better perceive our relationship with the environment. Today, in the

age of sustainability, it is equally, if not more, important to employ contemporary green technologies within the context of the aesthetics of landscape experience.

The Competition

The goal of Suburbia Transformed 2.0 is to promote and celebrate residential designs that go beyond "green" by explicitly using sustainable strategies, tactics and technologies to enrich the aesthetic spatial experience of people. ST 2.0 will assemble contemporary projects achieving this goal into an exhibition and catalogue. The emphasis is on how such sustainable landscapes can be beautiful, inspiring, perhaps profound; and serve as examples for transforming the suburban residential fabric, one garden at a time.

Significantly, this year's version, ST 2.0, invites the submission of visionary (unbuilt) work, along with built projects. Our hope is to trigger an instructive dialog between design that has been built and that which is untethered to the construction process. Such a curatorial stance has the additional benefit of opening up the competition to students, as well as professionals.

Eligibility

Open to all, including landscape architects, landscape designers, architects, individuals, teams or firms and students of design whose work will be judged in a separate category.

Submission Requirements

We seek solutions to the ubiquitous small-lot, detached single-family, residential condition in the hope that we may better understand how to transform suburbia. Therefore, submissions must be for two-acre or less residentially zoned single-family properties. A submission with a newly built house is allowed as long as the lot was part of a pre-existing subdivision or town property. Distance from an urban center is not relevant for the purpose of this competition.

Each entry must be submitted on a CD to include the components in the order listed below and sent to:
The James Rose Center
506 East Ridgewood Avenue
Ridgewood, NJ 07450
Attention: Design Competition

Submission Components

1. Main submission:
    A multi-page PDF document that includes the following in the order listed:
        a. A 250-word or less description of the overall project specifically addressing how the project responds to the competition goal and design criteria

b. Existing Conditions Plan showing topography, planting, and structures (including first floor plan where appropriate), as well as any other relevant site and immediate context conditions
c. Site Design Plan
d. Eight to fifteen images keyed to the site plan with captions describing relevance to the competition goal and design criteria.*
**For visionary (unbuilt) projects on real sites only, to better communicate the intended spatial experience, a minimum of two detailed cross sections at 1"=10'-0" or larger is required.*

2. Supporting files:
   A folder consisting of separate image files for all images used in the main submission. This will be for exhibition and publication purposes, and files must be of high quality and high-resolution. All photographs, drawings, plans, and cross sections must be in .jpg or .tiff format at a minimum of 300 ppi (pixels per inch) at 16" x 20". **
   ***Entrants are responsible for obtaining permission for photographs with photographers for publication and reproduction by the James Rose Center. The James Rose Center will provide proper credit for photographs and other images, but will not assume responsibility for any copyrights or photography fees. The James Rose Center retains the right to publish, exhibit, and publicize all materials submitted.*

The CD shall be identified only by the number you have received upon confirmation via email of your Entry Form. Place the CD in a transparent case also labeled with the entry number. No logos or other form of identification shall be seen on the submissions. CD submissions must be received by March 9, 2012 no later than 5:00 PM. All submissions become the property of the James Rose Center.

The jury will review the submissions and select up to twelve outstanding projects in each category: built work; professional visionary (unbuilt) work, and student visionary (unbuilt) work. Those selected shall receive notification shortly after the jury makes their selection. The James Rose Center shall assemble exhibition displays and an exhibition catalogue from the submitted work. (See www.jamesrosecenter.org for an example of the 2010 exhibition) Exhibited work shall become the property of the James Rose Center.

Design Criteria for Judging

Selected submissions must provide landscape experiences that are beautiful, inspiring and/or profound; in so doing they should:

- Make the most of what's already on the site (earth, rocks, plants, structures, water) before importing or removing anything
- Use local, inexpensive, low-energy-consumptive, non-polluting materials and construction techniques before others

- Consider the landscape's potential to create useful resources rather than consume them
- Consider the relationship of the site to larger environmental systems
- Consider means for guiding future growth and evolution of the garden

Jurors

- Cornelia Oberlander OC, FASLA, FCSLA, LMBCSLA, Landscape Architect
- Meg Calkins, LEED AP, ASLA, Associate Professor of Landscape Architecture, Ball State University
- Matthew Urbanski, Principal, Michael Van Valkenburgh Associates, Inc., Landscape Architects, P.C.
- Joseph S. R. Volpe, Professor, University of Massachusetts, Amherst
- Julie Bargmann, Associate Professor of Landscape Architecture, University of Virginia; Founding Principal, D.I.R.T. studio.

Selected Outstanding Projects Receive

- Public exhibition at the James Rose Center
- Publication of work in select design periodicals
- Publication of work in exhibition catalogue
- Copies of catalogue at reduced rate
- Recognition on the James Rose Center and NJASLA websites among others
- A framed custom awards certificate, presented at the opening reception
- Professional photograph of award presentation for publicity purposes
- Further exposure through traveling exhibition

Schedule

August 15, 2011	Call for Entries posted
February 17, 2012	Entry Form and fee due
March 9, 2012	CD submission due
March 24, 2012	Jury convenes
May 19, 2012	Opening Reception at James Rose Center
August 31, 2012	Exhibition travels

To Enter

Fill out the Entry Form available on the website, www.jamesrosecenter.org. An entry fee of $95 ($35 for students) must be received together with the Entry Form by February 17, 2012. You may either return the form electronically using PayPal, or mail it with a check payable to the James Rose Center to:

The James Rose Center
506 E. Ridgewood Ave.
Ridgewood, NJ 07450
Attention: Design Competition

We will confirm receipt of your entry form via email and assign you a number to identify your submission. This number must be placed on your CD submission. No other identifying marks are allowed.

Questions

Please email questions to designcompetition@jamesrosecenter.org by February 1, 2012. We shall reply via email asap. All questions and answers shall be posted on the James Rose Center website by February 13, 2012.

Other Notes

The James Rose Center, a non-profit landscape research and study foundation, is headquartered in Ridgewood, New Jersey at what was formerly the home of James Rose, built in 1953 for himself and family members. Before he died in 1991, Rose set in motion the establishment of the Center and created a foundation to support the transformation of his Ridgewood residence for this purpose.

The mission of the Center is to contribute to a more sustainable suburban condition through preservation, research and design. It provides and/or sponsors authoritative lectures, tours, classes, symposia, professional historical documentation, modern landscape preservation, consultation and research, student and professional awards programs and student internships. To learn more about the Center and this competition see www.jamesrosecenter.org.